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THE ELECTRICAL WORLD

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The Brush Storage Battery and Manipulator at the Electrical Exhibition.

The remark has been made that storage or secondary batteries are conspicuous by their absence at the Exhibition. This mistake may have been made by a casual observer, because such batteries are, as usually located, inconspicuous objects, and, furthermore, are locked up in covering containers to keep meddlers away. Inquiry is necessary for the searcher to find the Brush batteries; then Mr. Holt, the superintendent of the Brush Exhibit, courteously opens the bins, located in separate parts of the building, which contain the two batteries, each of twenty-one cells, and explains the construction and operation of them, and then opens the manipulator to show its internal mysteries. We are going to try to relieve him of a part of his daily task by describing the apparatus for our readers.

Fig. 1 shows the manipulator, and Fig. 2 shows four cells of the battery. Each of the two batteries consists of twenty-one of these cells. Each cell has three cast-lead plates in it. The two outer ones are the hydrogen plates, and the intermediate one is the oxygen plate. That is to say, by decomposition of the electrolyte ($H_2SO_4+H_2O$) during the passage of electric current through the cell, hydrogen is absorbed by the two plates, and oxygen is absorbed by the intermediate plate; both to be given up again to recombine to form water during action as a battery.

The centre plate is cast of about twice the thickness of the other two, but both kinds have the faces, which are turned towards a plate of the other kind, cast so as to have a grate-like form, with deep intersticial and longitudinal spaces between the bars. The plates are "formed," we understand, somewhat after the Plantè method, but under improved processes invented by Mr. Brush.

The plates are each 16×16 inches square. It will be seen that the two outer plates of each cell are connected together, and that a bar is carried from one of these plates to the centre plate of the next adjoining cell, so as to connect them up in the order called "series." The form of combined cells, shown by Fig. 2, has been recently abandoned by the Brush Co., and the separate cells, each to its own box, are placed closely together, but without touching. Each cell is also set on porcelain insulators, of a form resembling mushrooms. This substituted arrangement has been found necessary, owing to unavoidable electric leakage between adjacent cells when the combined box form was used.

Twenty-one of these cells give an electromotive force, while working, of about 38 volts, and supply 40 16-candle Swan lamps. A suite of two rooms, parlor and bed-room sumptuously furnished, are shown lighted in this manner; and also an adjoining room, which contains a Brush electric motor driving two looms. The practical capacity of this battery is said to be 240 lamp-hours from one charging. The charging is done at the rate of 20 ampères.

In a circuit connected with each battery is the manipulator illustrated by Fig. 1, which shows the door of the case open. The case is made of cast-iron, and it is attached to the wall by the screws, the heads of which are shown. The office of the manipulator is to make suitable contacts so that a current of electricity may flow to the battery when needed to charge it; to stop the current whenever the battery is fully charged; to close the circuit from the battery to the lamps; and then again to close the charging circuit whenever necessary to replenish the battery, and to record the time during which the charging current flowed—all automatically.

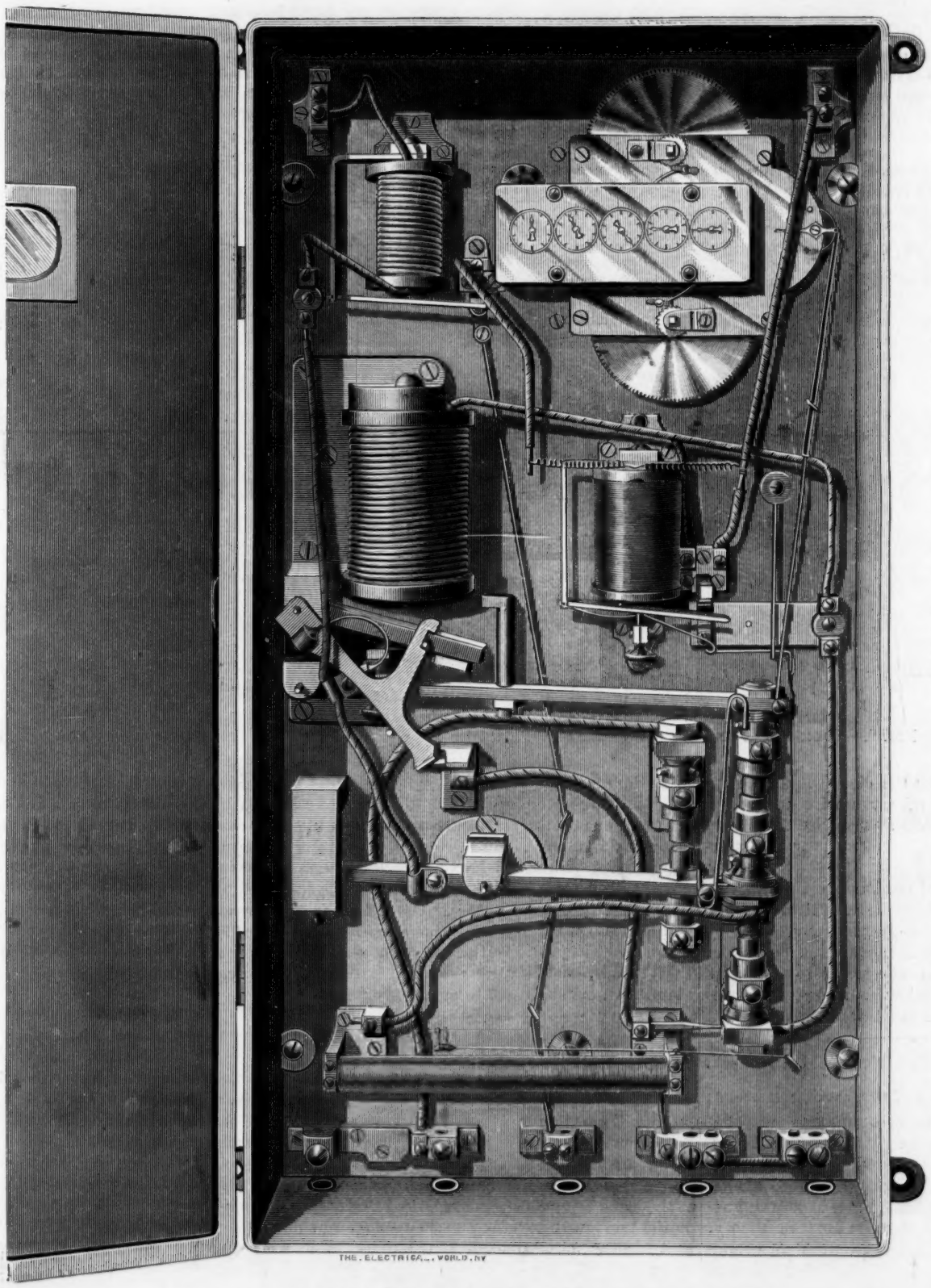

FIG. 1.—THE MANIPULATOR, BRUSH STORAGE SYSTEM.

How the apparatus operates we proceed to describe: The circuit for the charging current, as the parts shown are in the figure, is from the upper right-hand corner, down the obliquely placed wire to the clamp alongside the fine wire magnet in the central part of the figure, from there by the wire running up and behind the nearly horizontal wire to the larger coarse wire magnet and back by the nearly horizontal L-shaped wire to the clamp in the right central part, and then from there down to the fixed clamp which holds a vertically placed short piece of electric light carbon pencil. Thence the circuit is divided, but the divided courses need not be followed, and comes together again at the clamp at the left of the tipped T lever and continues to the small coarse wire magnet at the upper left-hand corner.

There is a derived circuit including the fine-wire magnet, and its course is shown through the fine helical wire to a contact point at the lower right-hand corner of the small magnet. As the parts in the figure are placed, the derived circuit is open, and it needs to close it to have the lever-armature under the small magnet raised to a horizontal position.

When the charging current is started, the large magnet is energized, it then pulls its armature upward; and it raises thereby the long horizontal lever just under it by its armature coming into contact with the ┐-standard on the long levers. The armature of the small coarse-wire magnet is also raised and thereby presses two contact strips together to close the derived circuit through the fine-wire magnet.

The long horizontal lever carries at the end of its long arm (at the right), a clamp which holds, also, a piece of electric arc-light carbon. The parallel lever just under the former carries two clamps containing carbons. The clamp and carbon at the end of this lever (at the right) are insulated from the lever.

When the upper lever is lifted, the under lever follows it and first breaks the circuit between the lower carbon and that on the under lever. Current then flows across the bridge-piece and through the fine iron-wire open-helix resistance placed horizontally near the bottom of the figure; and then through the wire above the iron-wire helix to the carbon at the under end of the lower lever; through that carbon and the one above it; and then through the upper lever to the clamp and vertical wire as before.

But the current takes that course only for the instant during which the lever is rising. Directly thereafter the other carbon on the lower lever comes into contact with the carbon in the fixed clamp just above it, then the upper lever is still further raised and its carbon is taken out of circuit. The current then takes this course: Down the short wire from the right-hand end of the fine-wire helix to a clamp over the fourth hole (counting from the left) in the bottom, which receives the wire running to the storage battery; through the storage battery up through a wire running through the second hole to the clamp above it; through the wire leading from the clamp to the fixed carbon; through that carbon and the one under it, the lever and the wire therefrom to the vertical wire, small magnet, and out of the apparatus.

The current continues through the battery, unless otherwise interrupted, until it is fully charged. Then there happens a sudden and rapid rise in the electromotive force of the battery, and consequently an increased flow of current in the derived circuit fine-wire magnet. This increase of current in the fine-wire magnet causes it to raise its armature, which, coming into contact with the spring contacts above it, closes a short-circuit around the large magnet. Consequently, the large magnet's armature drops, and the levers also, into the position shown in the figure. The circuit to the battery is thus opened at the point between the lower lever carbon and the fixed carbon above it, shown as separated.

The current from the charging source continues to flow through the course first described; while the current to the lamps from the battery flows up a wire through hole 4 across the fusible strip between the two clamps, down through a wire in hole 5 to the lamps; up through a wire in hole 1 across the clamps and down through a wire in hole 2 to the battery.

When the current from the charging source is stopped, the armature of the small coarse-wire magnet drops, and in so doing short-circuits the fine-wire magnet so that *its* armature drops, and restores the circuit through the coils of the large magnet. This restores the parts to the condition and position first described, and as shown in the figure.

The clock-work shows on the several dials the number of hours and quarters of an hour during which the charging current has flowed through the battery. A wire which acts as a stop or start to the clock mechanism, is attached to the end of the upper horizontal lever. When that lever is lifted in the process of making circuit, the wire which presses against the balance or escapement wheel of the clock-work is raised, liberated therefrom, and thereby imparts motion to the wheel so that the clock commences to record time. When the lever falls, the wire-stop comes into contact again to stop the clock. The clock will run many hours to each winding, and of course, for any desirable length of time.

The apparent complications of mechanism and function thereof are necessary to prevent dangerous firing of the parts, and other evils. The step-by-step movements by which resistances are removed reduce sparks at the contact to minimum. Any one who has attempted to introduce and remove currents of high tension from storage batteries by hand or otherwise will appreciate this apparatus.

Fig. 2.—Four Cells of Brush Storage Battery.

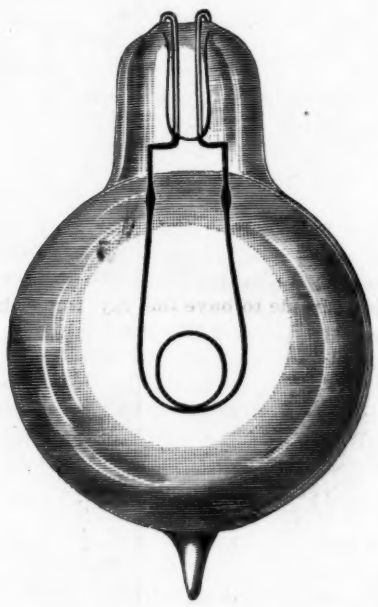

Fig. 3.—Swan Lamp Used with Brush Storage Battery.

Exhibits at the International Electrical Exhibition—IV.

We continue below our notices of the leading exhibits;

THE CHICAGO INSULATING COMPANY.

This company make an interesting display of insulators. They exhibit in the east gallery, the new well known Fiske-Mott insulators, and also their own Marmolite insulators. The Fiske-Mott insulator has proven in actual practice to possess all the advantages claimed for it in theory, and is now asserted to be without a rival in high insulation. It is steadily gaining in the favor of telegraph and telephone lines, and has been adopted by many of them. Recent tests show it to possess nearly 200 per cent. better insulation than ordinary forms of insulators. The principle of reducing the contact of the wires, so universally recognized by the best authorities, has been successfully applied here. The Marmolite insulating knobs also possess superior insulating qualities, as the material, besides being held a better insulator than porcelain and glass, does not attract moisture, nor can it be covered with a film of moisture in wet weather. The screws are imbedded in the material, closing up an avenue for leakage, and making them easier to handle and attach to the supports, besides preventing loss of screws. Several prominent telephone and electric-light companies have adopted these knobs. They are also made in colors to suit the interior decorations of rooms when arc lights are used. The same material is used in the telegraph hooks, and has proven, it is said, to be vastly better than combinations containing rubber, as time and weather have no deteriorating effect upon the composition.

HOLMES, BOOTH & HAYDENS.

The display of this firm in the east gallery, is well worthy the close inspection of electric-light, telephone and telegraph companies. There is shown a full line of the firm's manufactures, including hard-drawn copper line wire, magnet wire, patent "K. K." copper and iron wire, red and white braided iron line-wire, etc.; and the tasteful style of arrangement certainly does not detract from their intrinsic merits. The beautiful finish and perfect insulation are deserving of high praise. We observe that the electric-light wires used in testing by the Board of Examiners are from the firm. Mr. Theo. Larbig is in charge of the exhibit.

VULCANIZED FIBRE CO., WILMINGTON, DEL.

In the west gallery is to be found the exhibit of the Vulcanized Fibre Co., of Wilmington, Del. This material, now well known in electrical industries, is made of vegetable fibre, reduced to a pulp, and then subjected to powerful chemical treatment by means of which the original properties of the fibre are entirely changed. The resultant substance possesses great strength, elasticity, durability and insulation. It is in extensive use as an insulator where no direct contact with moisture occurs, and can be seen to-day on all sorts of apparatus, as an efficient substitute for hard rubber, being lighter and cheaper as well. It is made in sheets about 40 inches wide, by about 60 inches long, and from $\frac{1}{32}$ to 1 in. thick. The sheets are entirely free from grit, are very hard and dense, and at the same time exceedingly tough and elastic under compression; and are not in the slightest degree deteriorated by age, but, on the contrary, improve by seasoning. It can be worked in a lathe, drilled, riveted, sawed, and stamped; can be fitted with sharp, strong screw threads, and receives a fine polish. It is not brittle, and cannot be fractured by a fall, or any ordinary blow. The exhibit includes bases and trimmings for electrical instruments, magnet heads, sections of rail joint insulated by it, tubes, bolts and nuts, sheet goods, and a variety of applications. Electrical manufacturers ought not to miss this exhibit.

Exhibition Notes.

We give elsewhere in our columns to-day some particulars with regard to the contracts awarded for lighting the New Orleans Exposition by electricity. It will be seen that the managers will use the electric light on a very large scale, being satisfied that it is the only illuminant suited to their purpose, in the manner mentioned. It is significant that at this time is published the report of Professor G. Forbes on the London Health Exhibition display, in which he says that it is the most extensive application of electric lighting ever seen in England. Evidently, the electric light has a special adaptation to large exhibitions, and will be in increasing demand for such use.

The improvement made in electric lighting from the time of the Centennial Exposition to the New Orleans Exposition, the London "Healtheries," and the Electrical Exhibition at Philadelphia is so immense that many volumes could not recount it. The present exhibit of Wallace & Sons at Philadelphia gives some notion of the ground covered, and a conversation with Mr. Charles Stowell at the exhibit will assist any one interested to realize the work done during the decade 1875–1885. When in 1876—not to go back earlier—Mr. Stowell, on behalf of the firm, showed an arc light in Machinery Hall, and three on top of the towers of the hall, the sensation was very great, but there were few who understood how the light was obtained, and the reportorial hosts almost to a man were eloquent in expatiating on the beauty of the new "calcium lights." The times have changed since then, and away down in the New South, the managers of the great exhibition that is to mark a new era there, order, as a matter of detail, arc lights by hundreds and incandescent lights in thousands.

Among the interesting, though not strictly electrical, features of the Electrical Exhibition is the table of the Philadelphia Bible Society, where a small book containing a verse of scripture in 215 languages is sold for ten cents, and another verse in 168 languages is given to every purchaser. In addition, there is the smallest Bible ever published. It weighs a little more than three ounces, and can be carried in the vest pocket.

A curious illustration of the prescience of Bible texts is a card on which is inscribed the passage from Job:

* *
*
* Cans't thou send lightnings, that they may *
* go and say unto thee, "Here we are?" *
*
* *

The meeting of the Electrical Engineers next week—the last week of the Exhibition, according to the official programme of the Directors—promises to be very interesting, valuable and beneficial to the science. The Secretary has issued a circular naming over forty railways that will accept return tickets issued under the certificate plan. The Hotel headquarters will be at the Continental, and a better place could not be selected. It is arranged that the opening meeting shall be held in the hotel parlor on Tuesday, the 7th, and that the members shall devote the afternoon and evening of that day to the Exhibition. Wednesday and Thursday will be given to the reading of papers, of which several are in hand or promised, and the discussions are likely to be brisk, some of the subjects brought up being questions of the hour. The attendance of members of the Institute at the Exhibition has been large and steady throughout, and it is expected that the muster next week will be very good. Prominent foreign electricians will take part in the proceedings. The Franklin Institute is extending all the courtesies in its power, and our advice to members who have it in their power to visit Philadelphia is to go next week.

The following, from the Philadelphia *North American*, will be not without interest to many of our readers: Mr. Clarence E. Stump, formerly of Cincinnati, business manager of the New York Electrical World, and at present in charge of the exhibit made by the paper at the Electrical Exhibition in this city, was married on Sunday, the 21st September, to Miss Anna L. Cooper. The wedding took place at the residence of the bride's parents, 264 Kosciusko street, Brooklyn.

A lady who visited the Electrical Exhibition pronounces it a "magnificent enigma." She has seen it, but she can't make it out. She has been presented with a set of Houston "Primers."

Mr. Edison, who has taken a warm interest in the success of the Exhibition and done his best to insure it, has placed a brilliant star of 108 of his incandescent lamps on the tower, at the main entrance.

The attendance at the Exhibition has been good and growing. The total number of visitors down to the end of this week will not fall far short of 200,000.

There has been talk in plenty about continuing the Exhibition after the 11th, but we have heard nothing definite up to the time of going to press.

Magnetometers at the Electrical Exhibition.

(*Continued from page 94.*)

Carpentier's magnetometer instruments exhibited by J. W. Queen & Co., shown in Figs. 1 and 2 of our previous article, are for use in determining the value of H after the method laid down by Mascart. The method is essentially that which Gray provides for in his instruments in the description we have quoted and referred to. We will describe them and their accessories. The case B of Fig. 1 is 8 centimetres in diameter and 10 centimetres high, and is mounted on a circular plate C, supported by a tripod, having adjusting screws for purposes of leveling.

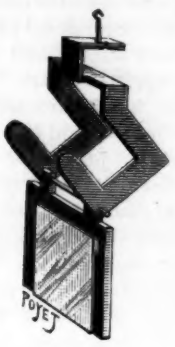

FIG. 6.

FIG. 4.

FIG. 5.

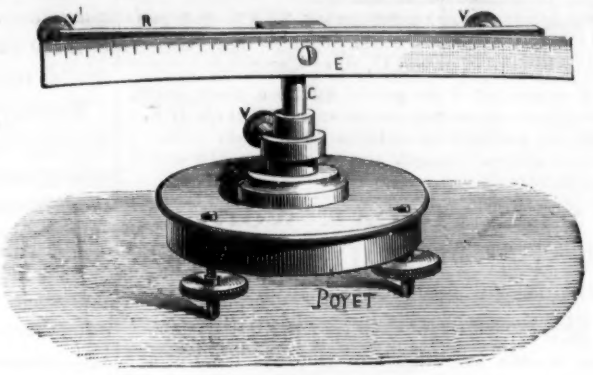

FIG. 8.

The base of the case is rotatable on the plate, and is graduated in vernier scale in common with the plate. The lens O has a focal distance of 1 metre.

The hollow metallic column V is mounted with its base on the circularly graduated top C of the case. The top of this column has an axle T to which is attached the filament by which the bar A is suspended. The filament is a thread of raw silk, 25 to 30 centimetres long. The bar A is five centimetres long. Its carrier is shown in detail by Fig. 4. The carrier supports a small rectangular mirror (M, Fig. 1) with its vertical plane at right angles to the length of A. The horizontal oscillations of the bar are shown by a ray of light reflected from the mirror through the lens O.

A second vertical mirror, Fig. 5 (and M^2 Fig. 1), is fastened to the inside bottom of the case in an exact vertical and horizontal position by means of the screws E E^1. Another form of carrier is used. It is shown in Fig. 6. One or the other of these two forms is used according to whether it is desirable to have the ray from the mirror parallel or perpendicular to the bar A.

The telescope used for viewing the reflection of the lines of the scale (Fig. 8) is shown in Fig. 7. It is provided with fine vertical lines on its lens to facilitate the reading. It is mounted on a tripod having leveling screws. The clamp screw V binds the quadrant attached to the axis, so that the instrument may be turned to any angle from the horizontal.

The reading-scale is shown by Fig. 8. The graduation is on a plate of ivory, and is in demi-millimetres. Its total length is 20 centimetres. It is screwed at its center E to a metallic bar R which is fixed horizontally to the rod C, which is movable vertically within a hollow column, but is held at any desired position by clamping through means of the screw-clamp V. The whole is mounted on a tripod with leveling screws. Two other screws V' are used to bend the ivory strip to the arc of a circle, the radius of which is the distance of the scale from the face of the mirrors.

While the unifilar is used as a declinometer, that is to determine the period of oscillation of the magnetic bar, the bifilar is used to measure the variations in the horizontal component of the earth's magnetism. It has the same general external appearance of the unifilar, or

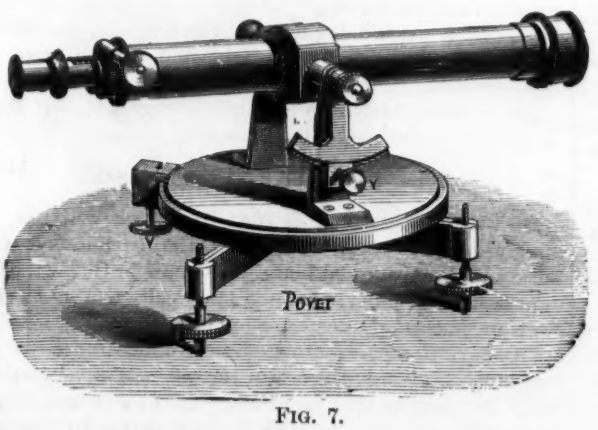

FIG. 7.

declinometer. It has the fixed mirror M' and the oscillating mirror M, and the two are adjusted by the same means.

The principal difference consists in the mode of suspending the bar A. The carrier of the magnet A is suspended from the two axles T and T' by two filaments of silk placed about five millimetres apart. The axle T supports the filaments, and the axle T' has right and left threads cut in it like a double screw, so that the filaments rest in the grooves. Movements of T regulate the distance apart of the filaments, in obvious manner, to adjust the sensitiveness of the instrument. The graduated circles C and C' have verniers and adjusting screws.

Another instrument, under Mascart's method, is the Magnetic Balance, shown by Fig. 9. It consists of a magnetic bar A, having a knife-edge axis C, resting on agate plates. It is suspended at its center of gravity in the magnetic meridian, and its inclination is compensated by a weight consisting of a nut T which is movable on the threaded bar. This nut bring the magnet into horizontal

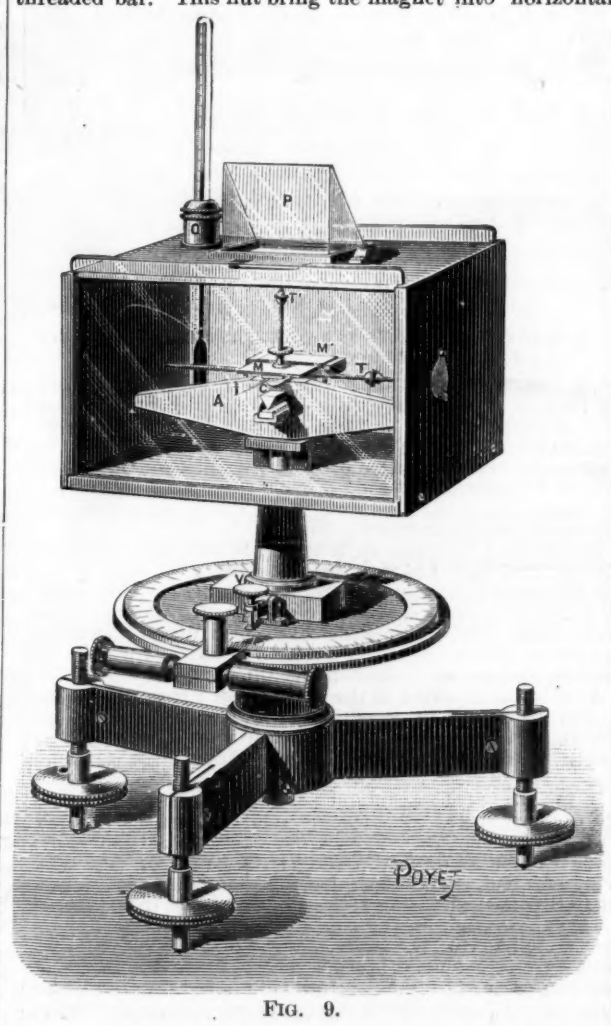

FIG. 9.

position. A second nut T^1 is movable on the threaded vertical rod. By elevating or depressing this nut the centre of gravity is correspondingly moved, and thus affects the sensitiveness of the instrument. When the balance is not in use, the knife-edges of magnetic bar are raised from the agate plates through the medium of a tee-piece, which is elevated or depressed by means of the screw V.

Placed with their reflecting planes horizontal are two mirrors M and M'. One M is movable with the magnetic bar and the other M' is fixed upon the top of standard at the rear of the magnet. In the top of the case there is xed an isosceles rectangular prism P with the faces a little convex, equal to a lens having a focal length of one metre. At O is a thermometer. The front and rear of the case are closed by glass plates.

The comparison scale, Fig. 10, is used with the bifilar and the balance. It is intended to measure that fraction of the two components which corresponds to a division of the scale. The rule D is divided into millimetres, and is mounted on a brass base. A carriage R, movable on the rule, carries a vertical circle C perpendicular to the plane of the rule, and the circle holds the magnet-bar used to determine the deviation. The circle is movable on its axis in the vertical plane. One of the extremities of the rule terminates in an abutting-gauge B, movable vertically and fastened by the set screw V. This abutting-gauge is placed against the case of the instrument with which the comparison rule is used.

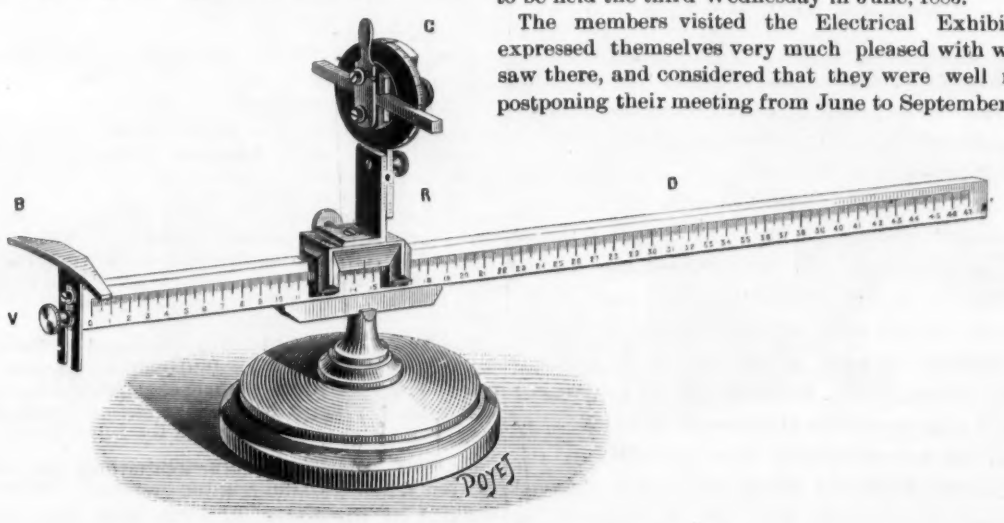

FIG. 10.

(*To be Continued.*)

The Association of Railway Telegraph Superintendents.

The third annual meeting of the Association of Railway Telegraph Superintendents was held at the Colonnade Hotel, Philadelphia, on the 17th ult.

Fifteen railway companies were represented and a number of letters were received from those unable to attend.

Thirteen new members were admitted to the association. The committee on revision of the constitution reported, recommending several changes which were, after some discussion, adopted. The report of the Treasurer was read, showing receipts to have been $126.25; expenses, $80; balance on hand $46.25.

A very interesting discussion followed upon the question of handling the trains by telegraphic orders and the relation of the superintendents of telegraph to that branch of the service. Most of the members favored the putting everything in regard to telegraphic orders under the superintendents of telegraph through their chief dispatchers and division operators, while others thought the transportation department should control the dispatchers, except so far as their duties demanded their attention as circuit managers, when they should be under charge of the head of telegraph department. Harmony of action between superintendents of telegraph and division superintendents was urged in regard to these matters in order that both railway and commercial telegraphing might be benefited.

Resolutions of thanks to the retiring president, Mr. W. K. Morley, for his successful efforts in organizing the association, was unanimously adopted. Election of officers resulted as follows:

President—C. Selden, Baltimore.
Vice-President—E. C. Bradley, Columbus, O.
Secretary and Treasurer—P. W. Drew, Chicago, Ill.

Cleveland, Ohio, was chosen for the next annual meeting, to be held the third Wednesday in June, 1885.

The members visited the Electrical Exhibition and expressed themselves very much pleased with what they saw there, and considered that they were well repaid in postponing their meeting from June to September in order to be present. As nearly all the railway companies now put their telephone, electric signals and electric lights under the charge of the telegraph department, the superintendents were, of course, interested in everything at the Exhibition. Various insulators, cable wires, conduits, dynamos and telephones were critically examined, and intelligent impressions received. A cordial invitation was received from the B. & O. Ry. Co. for the association to visit Washington.

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This paper is printed on a Cottrell press, by a Daft electric motor, at the International Electrical Exhibition, Philadelphia.

REPORTS OF THE NATIONAL CONFERENCE PROCEEDINGS.

We have received from our esteemed contemporary, *Science*, two circulars that are, to us at least, very amusing in character. One of them announces the fact that the paper is about to issue special supplements devoted to reports of the discussions of the National Conference of Electricians, at Philadelphia. Special rates are offered for advertisements in said supplements. The first supplement will not appear until *after* September 30. The other circular states that the paper has, either for love or money, come into the possession of "the only copy of the official report obtained by any American newspaper." To this is added: "The *Electrical Review* of London had obtained a similar report."

It happens that we were among the first to recognize the importance and interest of the proceedings of the Conference, and that in consequence we made arrangements for obtaining full reports of them. We have already published no fewer than ten solid brevier pages of reports, and this week we give another very substantial installment. We have also had drawings and cuts made to illustrate the discussions wherever desirable. In order to "cover" the proceedings as well as possible, two of the editors of The Electrical World were in constant attendance.

It would therefore seem that *Science* is a little late in beginning to publish reports *after* September 30, when we, with accustomed promptness, have already given three-fourths of the proceedings, and have reached the closing sessions. Morever, in order to get "the only copy of the official report," *Science* must use our columns, as we still hold the originals of some of the documents and addresses. For instance, Prof. Rowland himself gave one of the editors of this journal the manuscript of his opening address, and we have numerous other papers. Then the statement that the *Electrical Review*, of London, obtained a similar report, is not strictly true. Mr. H. Alabaster, of that paper, devoted himself to the Conference and attended steadily. In addition, he secured the services of Mr. Morgan, a well-known stenographer in Philadelphia, and that gentleman took verbatim notes for him. Perhaps *Science* is not aware of this, but it need only apply to Mr. Alabaster and Mr. Morgan for confirmation of what we say.

We do not for a single moment question the good faith of *Science* in issuing circulars of this kind, but we must express our opinion that the circulars are neither just to the persons invited to advertise nor to this journal and the English *Electrical Review*. If *Science* has a good report, it can only reproduce what we have already given, relying upon us for certain portions of which we hold the originals, although it is "the only newspaper in America" that has a copy of the report. Besides, when our English contemporary has gone to unusual expense, like ourselves, to get first-hand reports, *Science* is hardly treating it fairly in saying curtly that it "obtained a similar report."

We regarded a report of the Conference so much as a matter of course for The Electrical World that we did not concern ourselves about calling attention to the thorough manner in which we were treating the subject. Now that *Science*, just as we are closing our report, and three weeks after we began it, appeals for special advertising patronage on the strength of having "the only copy of the official report"—which it has not—we are bound in simple self-defense to make the above criticism and explanation. We think *Science* has issued its circulars under a misapprehension.

PRINTING BY ELECTRICITY.

It is well known to all our readers and to the visitors to the International Electrical Exhibition at Philadelphia that this journal has been regularly printed there during the continuance of the Exhibition, our object being to show the electrical transmission of energy, as applied to a department of work in which we are specially interested. Every electrician knows, of course, that the thing has been done before. We are, therefore, not a little surprised to find in the Ilion, N. Y., *Citizen*, of Sept. 26, the following extraordinary and outrageous statement with regard to our exhibit:

BORROWED (?) THUNDER.

"THE ELECTRICAL WORLD" CLAIMING THE HONOR IT ONCE ACCORDED THE CITIZEN—ALL FOR LUCRE.

The Electrical World which is published in New York city, is now printing an edition at the Electrical Exposition at Philadelphia; and the printing press is run by an electric motor. Large placards hung on and about the press assert that that is the first newspaper in the world printed by electricity; and, as such, thousands of copies are being sold to the credulous people to be stored among the household penates and archives.

If this same Electrical World will look in its issue of March 15, 1884, it will find these words:

"Printing a Newspaper by Electricity.—The Ilion, N. Y., *Citizen* printed its entire edition of 3,000 copies on March 13 by electricity, using an electric motor, deriving the current from a ten-light dynamo 15 rods away. It is the first newspaper in the country thus printed."

As this was reported in the Associated Press dispatches it will be found in nearly all of the leading journals of March 14th, and many of them commented editorially at length upon it, as for example the New York *Evening Telegram* and New York *Journal*.

But this is not the worst. Upon request of the publishers of The Electrical World, the publisher of the *Citizen* wrote a descriptive letter of the operation, which same letter will be found in the World of April 5. Did man ever, ever behold such mendacious audacity? We think not. It is not such a terrible thing to have thus printed the first newspaper in the world by electricity; but, having done it and having the same made worldwide in note, we dislike to see the very journal which made the most of the fact then, now coming out and claiming the same notoriety for itself which it has already accorded another newspaper.

The *Citizen* of March 14 will be found in many museums and among keepsakes, and we are glad now that the date of that paper is March 14. The World will doubtless feel like singing "Backward, O, backward turn, time in thy flight." But "time and tide wait for no man." The deed is done.

In other parts of the same paper we find these further inuendoes:

Although a very large edition of the *Citizen* was printed March 14—the first newspaper in the world printed by electricity—the supply was entirely inadequate to the demand and hundreds of order for them were never filled. Many were sent to museums and collections of curiosities all over the land—upon request, but the supply gave out very early in the canvass. Those who are buying The Electrical World at Philadelphia are doubtless getting the worth of their money, but they will feel cheap if they ever find out that printing a newspaper by electricity is old.

Papers are being sold by the thousand at the Electrical Exposition being held at Philadelphia, because they are called the first in the world ever printed by electricity. Our neighbors are a little late. The *Citizen* of March 14, 1884, was the first newspaper in the world thus printed.

If there be any "mendacious audacity" about the matter, it lies with our wanton assailant. We have never claimed in any shape or form that The Electrical World was the first paper in the world printed by electricity. Such a claim would be ridiculously absurd. The feat of printing a paper by electricity is an "old" one. Thomas Davenport, an ingenious blacksmith, at Brandon, Vt., obtained patents in 1837, constructed what is supposed to have been the earliest practical electric motor, and with it is said to have run a printing press. Besides, papers have been printed in Europe by electricity several times. Hence, it would have been the height of folly for us to venture on any such assertion as the *Citizen* with utter recklessness says we made, and which, without any foundation whatever, it makes for itself. What the facts are with regard to the *Citizen*, we noted last March. Its engine broke down, and as no other engine was available, the use of an electric motor was suggested to the proprietor by Mr. Geo. M. Lee, an electrician connected with the Remington Electric Light Company. Being convinced by Mr. Lee that the thing could be done, the proprietor hitched up a borrowed motor to his press and printed that edition. We gave publicity to the matter and were liberal in our praise of the accomplishment. Such as it was, the event remains on record.

We repeat that we have never claimed or stated that which the *Citizen* says we have stated, and we think an apology is due us. If the proprietor of the *Citizen* before it offered us this gratuitous insult had written to this office or visited the Exhibition he would have known, and have seen in black and white, just what we claimed. When the Exhibition opened we placed over the Cottrell press a small placard—"large placards" are not allowed by the Exhibition management—reading thus: "The only paper in the world printed by electricity." To the best of our knowledge and belief the statement was true, and it passed without criticism, while our effort was approved by several distinguished scientists from England, who came and examined the working of the Daft motor and the Cottrell press. About the end of the first week, however, we noticed an item in print, to the effect that the Lawrence, Mass., *American* was also trying to print regularly by electricity. In order to be within the bounds of truth, we replaced that placard at once by another saying: "This paper is printed by electricity." That sign, our only one, has now been hanging, untouched, for four weeks. The circulars we have put out on the subject make no claim of the kind alleged, although as far as we are aware, The Electrical World is the only paper that has ever printed regular editions consecutively, week by week, with the aid of electricity. We have no information at all as to what the Lawrence *American* is doing, or what kind of paper it is issuing, but if it is printed regularly by electricity, we are very glad such is the case.

Our illustrated article on the subject of our exhibit, published Sept. 20, said simply: "To demonstrate the feasibility of the application of electricity to printing is our chief aim in making the exhibit." To go beyond that, as we are accused of having done, in an electrical exhibition attended by hundreds of the leading electricians of the world, all of them familiar with the history of electrical applications, would have been the extreme of insanity, especially after what we had ourselves published only a month or two previous. Our description of the exhibit, in the official catalogue of the Exhibition, was written by us before the Exhibition opened, and to that we refer anyone interested as confirmation of what we say above.

The publisher of the *Citizen* accompanies the copy of his paper with a postal card calling on us to "explain." We have explained. Now let him apologize.

PROTEAN POWER.

So many applications of electricity are shown at Philadelphia that it would seem some might easily be omitted without detriment to the completeness of the Exhibition. We cannot but regret, however, that more has not been done there to illustrate the principles and workings of electric railways. The motors are numerous, but this particular use for them—locomotion—has been neglected from one cause or another.

In speaking of motors, we may note two exemplifications presented to observation at the Exhibition of the correlation of forces. The Brush Company run an electro-plating machine by an electric motor, and thus, through the steam engine, heat is converted into motion, the motion into electrical current, electricity into mechanical energy again, that into electricity, and electricity once more into chemical action. Another instance is that in which the Burton electric heater is in circuit with a motor operating a sewing machine, three other motors of different sizes, and an arc light, the one current for all being furnished by a small dynamo—a Van Depeole, we believe. Thus there is obtained heat, light and motion from the same current.

The conservation of energy and the correlation of forces are no longer ideas beyond common appreciation.

THE TELEGRAPHIC OUTLOOK.

The death of the elder Garrett last week will not, we imagine, be without its influence on the Baltimore & Ohio Telegraph Company, although the younger Garrett, a man of pronounced ability, has been practically at the head of the Garrett corporations for some time and has secured in Mr. D. H. Bates an astute and active organizer for the larger and growing interests of the old telegraph company. There has been an idea prevalent, with how much reason it is hard to say, that the elder Garrett stood in the way of negotiations between his own and other telegraph companies. Anyhow, changes or developments of some kind in policy may be looked for, and are even now going on. The Bankers & Merchants' Company is meantime in desperate straits financially, and finds so far no stable prop for its falling fortunes. The manner in which for the past year it has undergone changes by consolidations and combinations, is highly suggestive of the dances in which one has a new partner at every other step.

Hedges' Spark-Reducing Switches and Commutators.

This form of switch, although comparatively new here, is one which has enjoyed great popularity among electric lighting engineers in England, so that we understand why, since the first introduction of the special pattern at the Paris Electrical Exhibition, over four thousand have been sold. The feature of the switch is the special form of contact, which is a round piece of copper pressed down by a helical spring, but left free to rotate. The current passes through a piece of strip copper, thus avoiding the chance of resistance in joints. This strip is kept clean by turning the top of the contact piece occasionally, which also equalizes the wear.

Fig. 1 is an ordinary contact breaker designed for small currents. Fig. 2 breaks the current in two places and enables its direction to be changed. Fig. 3 can be used either as a commutator for reversing the direction of the current, or for heavy currents such as are used in incandescent work.

For the first method the current would enter lamps at *B*, passing from the terminal *A* through the contacts of the

FIG. 1.

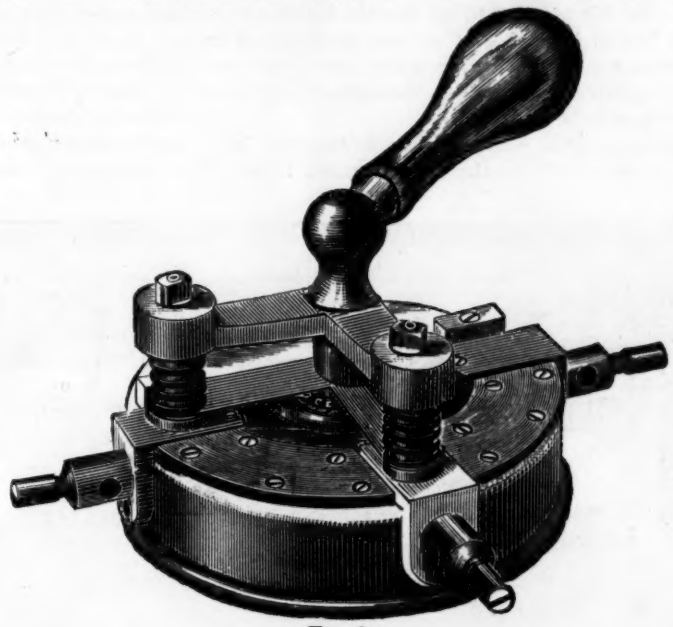


FIG. 2.

switch which are insulated from the centre piece. By sliding the contact which is on *A* on to *B*, the connection with *A* is broken and the current enters the line of lamps by the terminal *D*, used as contact breaker only, the line is split into two parts, entering at *A* and *B*, and leaving at *C* and *D*. Fig. 4 shows a commutator which is used either for inserting resistances, or putting in cells of secondary batteries and is specially designed for powerful currents. The inventor is Mr. Killingworth Hedges, who is to be congratulated on having designed a thoroughly serviceable article. His agents are the Electrical Supply Company, of New York, who show the goods at the Exhibition at Philadelphia, with the fusible safety plugs which we illustrated in a preceding number.

Measurement of Currents.

Lord Rayleigh has suggested the application of Faraday's discovery of the rotation of the plane of polarized light by an electric current as a means of measuring the current. Mr. J. E. H. Gordon found the reversal of a current of four ampères circulating 1,000 times round a column of bisulphide of carbon through which the polarized ray passed, produced a rotation of the plane of polarization of the ray of about 7½ degrees. With heavy glass, which is more suitable for measuring purposes, the rotation is somewhat greater. The method does not seem very promising, says *Engineering*, but in Lord Rayleigh's

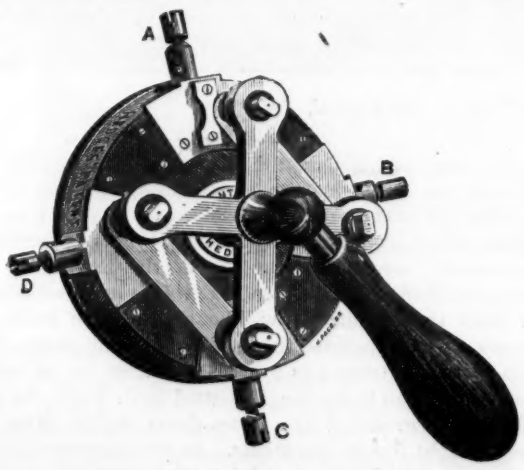


FIG. 3.

hands something may be made of it. It has the advantage of requiring no springs or gravity indicators, the ray of light serving this purpose. One drawback exists in the depolarizing properties of heavy glass. A more useful, if less novel, method of measuring current by means of the ordinary apparatus is also given by Lord Rayleigh. A standard cell is connected through a high resistance, such as a set of resistance slides, and two points in the slide are found which have the same difference of potential on two points of a strip of German silver through which the current to be measured is passed. The equality of potentials is found by a galvanometer in circuit which gives no deflection where the two points are found. Knowing the difference of potentials on the slides (it is equal to the electromotive force of the cell × the resistance between the two points on the slide ÷ the whole resistance of the slides), and the resistance between the two points on the German silver sheet, the strength of current is easily found by Ohm's law. It is equal to the above difference of potentials divided by the resistance between the two balancing points on the slide. This method is well-known; but the use of a German silver strip with lugs or projections on it a given resistance apart to serve for the points of connection in the balance, is a new modification.

Who was His Partner?

About ten days ago a man who was evidently a tramp wandered into the luxuriously furnished inner offices of Henry Clews & Co., the New York bankers and brokers. He was ragged, dirty, weather-beaten and looked as if the world had been very unkind to him. Mr. Clews is a kind-hearted man, and made up his mind that if the tramp asked him for 2 cents he would make it a dollar.

"I want to buy some Western Union," said the tramp. "How much can you buy for that?" and the visitor pulled out a large roll of bills.

Mr. Clews was so taken aback that he clutched the malachite mantlepiece for support, and a clerk in the front office was so overcome that he had to go out for a "bracer" in the shape of a gingerpop, which he afterwards said made him feel real devilish.

The supposed tramp had $1,500 in hard cash. Mr. Clews accepted his money as a margin and purchased 100 shares of Western Union, to be carried for his account. Yesterday the customer waited upon his broker, and ordered the sale of stock. The transaction was closed, and the strange customer put $400 profit in his pocket and walked out of the office.

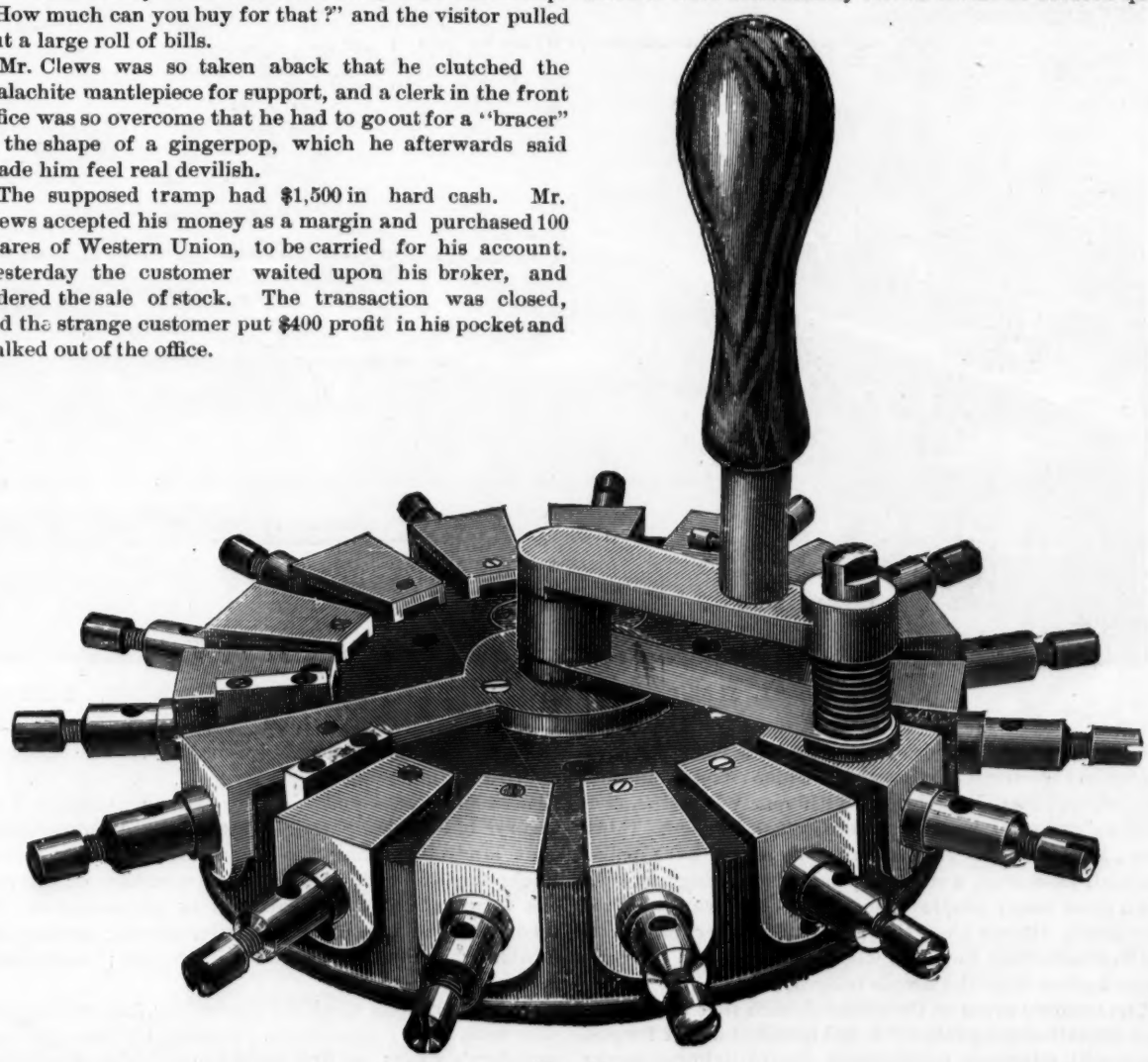


FIG. 4.

Lighting the New Orleans Exposition.

A dispatch of the 20th from New Orleans says: The managers of the World's Exposition to-day closed contracts for lighting as follows: The Leavitt-Mueller Electric Light, 800 standard arcs, for the main buildings; the Brush Electric Light, 300 standard arcs, for the Government and State Exhibit building; the Jenny Arc Light, 100 standard arc light, with five Star iron towers for the grounds and the live stock department; Thompson & Houston, 100 standard arc lights for the machinery, extension and saw mill; Edison Incandescent Light, 4,800 lights for the Music Hall, Horticultural Hall and the Art Gallery State Headquarters and offices. Each principal entrance and wharf will be lighted by 6 Leavitt-Mueller 36,000 candle power lamps. Fifteen hundred horse-power is required for the electric light, which costs the Exposition over $100,000. Proposals were invited, and all the companies bidding have been accorded representation in the awards. Negotiations are now progressing with the various Electric Railway Companies for an improved elevated road in the grounds. The Director-General reports that they will have a rail connection into the main building and the Government building on Monday, and will then receive exhibits.

The Efficiency of Lightning Rods.

An authority here has recently thrown grave doubts on the efficiency of the lightning rods in this country, on account chiefly of erroneous principles of construction and erection, and bad grounds. A contemporary states that Prof. Mohn, of Christiana, Norway, having been employed by the government to investigate the efficiency, of the protection afforded to buildings by lightning rods seems to have substantially settled the much-debated question, at least for that region of country. His report shows that light-houses, telegraph stations, and other exposed buildings, which were provided with conductors, did not by far suffer as much as churches, which in most cases were unprotected. It appears, in fact, that of about a hundred churches reported to have been struck by lightning only three were provided with conductors; that of these three the first had a conductor in good order, and the building was injured; the second had a conductor of zinc wire, which melted, and of course left the structure without protection; the third had a wire which was rusty where it joined the earth, and the church was burned.

Instruction in Electrical Engineering.

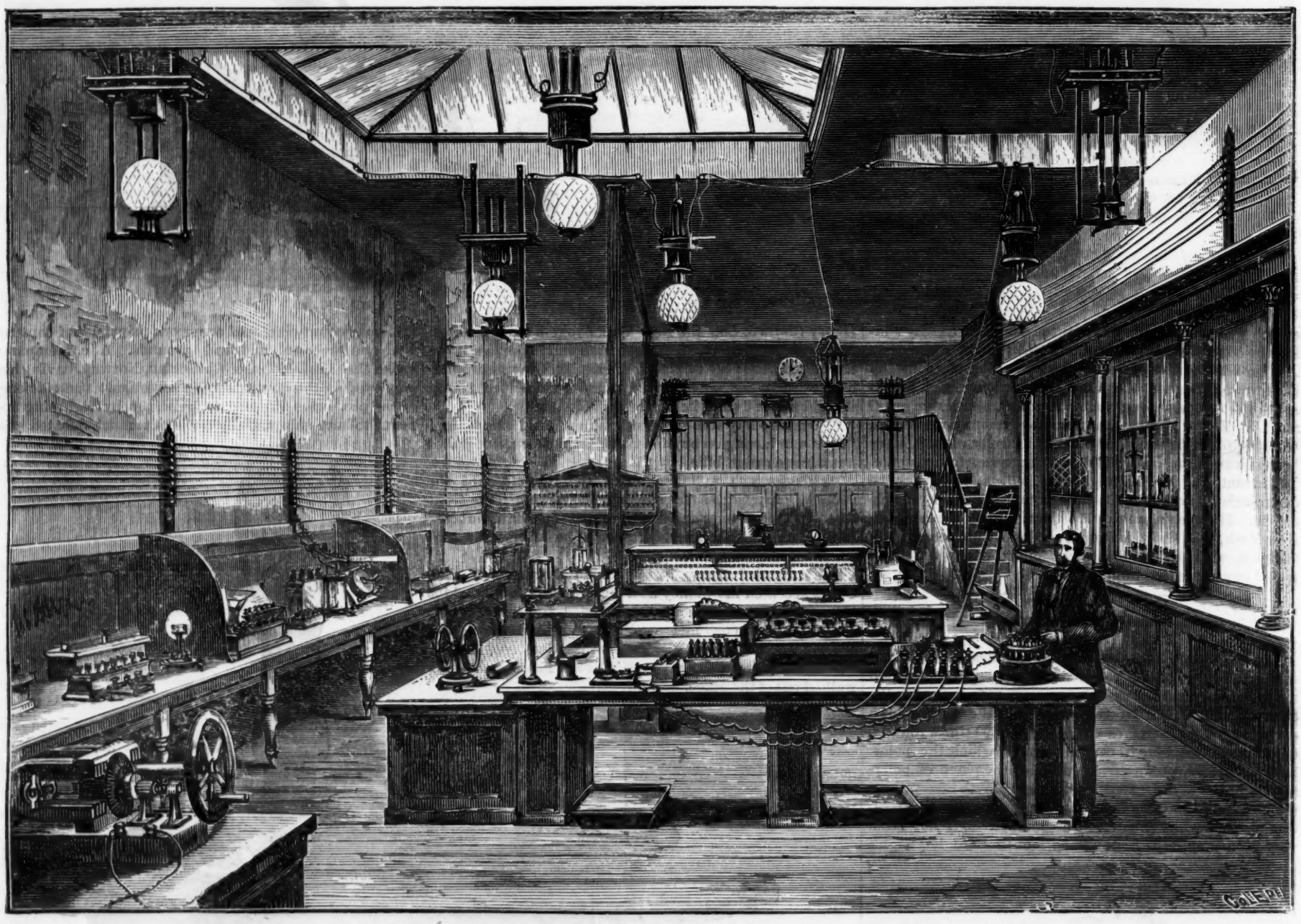
The rapid development of electrical applications during the last ten years has created a demand for competent electricians and has led colleges and technical schools to make electrical study a prominent part of their curriculum. In this country, the oldest seats of learning vie with those of modern foundation in bestowing attention on the "science of the future," and the active part taken by scholastic representatives in the proceedings of the National Conference of Electricians last month shows that the theoretical side of the science is far from being neglected. More of practical work is wanted, and more is being done, from year to year, but meanwhile many young men grow up and have to devote themselves to other careers who would choose electricity and its applications if they could early get an insight into and a grasp of the practice as well as the principles. We are glad to see that the Stevens Institute, Cornell University and one or two other places are paying to practice the attention it requires, and from their classes many valuable accessions to the ranks of electrical engineers are now to be expected.

It is interesting to note what our kin beyond sea have done in this respect, and we therefore furnish herewith some illustrations and descriptions of the school of telegraphy and electrical engineering, which was established in 1868, and is still carried on with marked success, at 12 Princes' Street, Hanover Square, London, by W. N Tiddy, Esq., M. S. T. E. No fewer than 3000 pupils have passed through its course, a striking proof that in England there are a great many people who realize the truth of Prof. Rowland's dictum that the age calls rather for electrical engineers than for those whose training will not carry them further than the simple telegraph key.

The training given at the school is such that any one of fair education can profit by it and qualify himself for positions with telegraph telephone or electric light companies, in a period of about nine months, during which, with proper application, he should master the elements of the science sufficiently to be of use. We have gone over some of the examination papers, and find them to exact a degree of proficiency that many men now in practical work would be proud of. Mr. H. L. Kempe is one of the examiners.

The practical portion of the course includes tuition and daily practice in the systems of telegraphy generally employed, and particularly in submarine telegraphy; also in the various systems of electric lighting, including the management of prime motors, arc and incandescent lamps, accumulators, etc.; and, lastly, in the various applications of telephony which have been carried into practice. No pains or expense has been spared to place at the disposal of pupils the technical and scientific instruction requisite to qualify candidates for the most important posts in connection with these new branches of electrical engineering. In order that the instruction in the erection, adjustment, testing and working of telephone and electric light circuits may be thoroughly practical, complete working telephone exchanges upon the various systems in use in different countries have been fitted up; every kind of telephone, both for exchange systems and private lines, with all apparatus used therewith is provided (in duplicate when possible, so that students may be able to dissect and reconstruct the same). The necessary tools and materials are available, and every facility is given for conducting experiments by pupils desirous of so doing, and a similar course is being pursued with the various lamps and machines, etc., in the electric light department, so that pupils from the school are in a position to enter either of these new fields. The theoretical portion, embodied in lectures delivered by well-known authorities to the various classes through which the students successively pass, embraces the following subjects: Gas and other motors; mathematics, general physics and chemistry, in relation to electricity; electro-statics; electro-dynamics (voltaic electricity); magnetism, electro-magnetism and magneto-electricity (including the theory of, and mode of, constructing dynamo- and magneto-electric machines); the theory of electric lighting by means of arc and incandescent lamps (including the principles of their construction); the theory and details of construction of the various forms of secondary batteries or accumulators; the theory of the telephone and microphone; testing and localizing faults in conductive circuits; engineering formulæ, etc., etc.

Our illustrations speak for themselves, but we may venture upon a few explanations. Through the manager's and secretary's rooms we first enter the two signaling rooms, where instruction in signaling is given on the "Morse Recorder," as well as the "Duplex" working of lines and translation. Wires representing land lines are fitted up, as well as artificial cables. In a period of time varying from four to six weeks, according to the natural aptitude of the learner, he finds himself at one of the "stations" of a "cable circuit," sending messages to, and receiving others from, his instructor or another learner. The progress he makes is ascertained and recorded from day to day, and the length of the "cable" through which the signals are sent and received is gradually increased. Ultimately he joins the advanced manipulation class, in which he obtains a practical knowledge of the difficulties in signaling, and of the peculiar character of the signals in case of very long lines. Here also he becomes acquainted with the "mirror" receiver, the "syphon recorder" of Prof. Sir W. Thomson, which deserves special mention as one of the most ingenious and successful inventions; and the "automatic transmitter" of the late Prof. Sir C. Wheatstone's translating apparatus. In order to reproduce exactly the electrical conditions which prevail in long submarine lines, a very expensive piece of apparatus—viz., an "artificial cable"—is absolutely necessary for efficient instruction in submarine signaling, and this school stands alone in the possession and use of this indispensable apparatus for instruction and experimental purposes. It was devised by Mr. Cromwell F. Varley, F. R. S., the Atlantic cable electrician, who has testified that the signals obtained by its means exactly correspond to those actually obtained through the Atlantic, the Eastern, Eastern Extension, Brazilian, and other long cables, according to its mode of adjustment. The signals which would be produced by a cable from England to India and Australia are shown daily by its means, and the pupils are thereby gradually accustomed to sections of this long line, comprising the following:—1, England to Gibraltar; 2, Gibraltar to Malta; 3, Malta to Alexandria; 4, Suez to Aden; 5, Aden to Bombay; 6, Madras to Singapore; 7, Singapore to Java; 8, Java to Australia. Sir W. Thomson also states that the signals and "speed of signaling" obtained with the artificial cable are altogether similar to those of the great submarine cables. This apparatus is as necessary for the instruction of the learner in the various methods of *testing* cables, as it is in familiarizing him with the signals he will be expected to read and transmit when appointed to a station on a submarine line



CENTRAL HALL, SCHOOL OF ELECTRICAL ENGINEERING, PRINCES' STREET, LONDON, W.

The process of testing as well as measurement of resistance is carried on in the large central hall, about 50 feet by 40 feet, surmounted by a glass dome which gives an excellent light for all operations. In the upper part of this hall lectures are also delivered by professors specially engaged. On one side of the room an electric light switchboard is fitted, about 15 feet in length, to which are connected electric machines in the basement. We may mention that not only a Brush, but also a Siemens alternating machine, W 8, and Siemens' dynamo, D 5, Gramme, besides several other machines are in use. Not only is a model Telephone Exchange fitted to the switch board, but a number of electric lamps of different systems are fitted throughout the hall and are worked by the pupils. From the alternating machine Siemens differential arc lamps are supplied, also an incandescent circuit, and besides the Siemens pendulum lamp there are Pilsen and Joel lamps, Brush arc lamps, the Swan, Fitzgerald, Edison, Lane-Fox,

and other incandescent lamps, etc. Through the wires being carried from the machines to the switch-boards, observations can be taken by means of a large commutator, resistance measured, etc. At the different tables the newest and best appliances are to be seen. At one of them all control tests are taken, those of the junior pupils being verified by the more advanced ones.

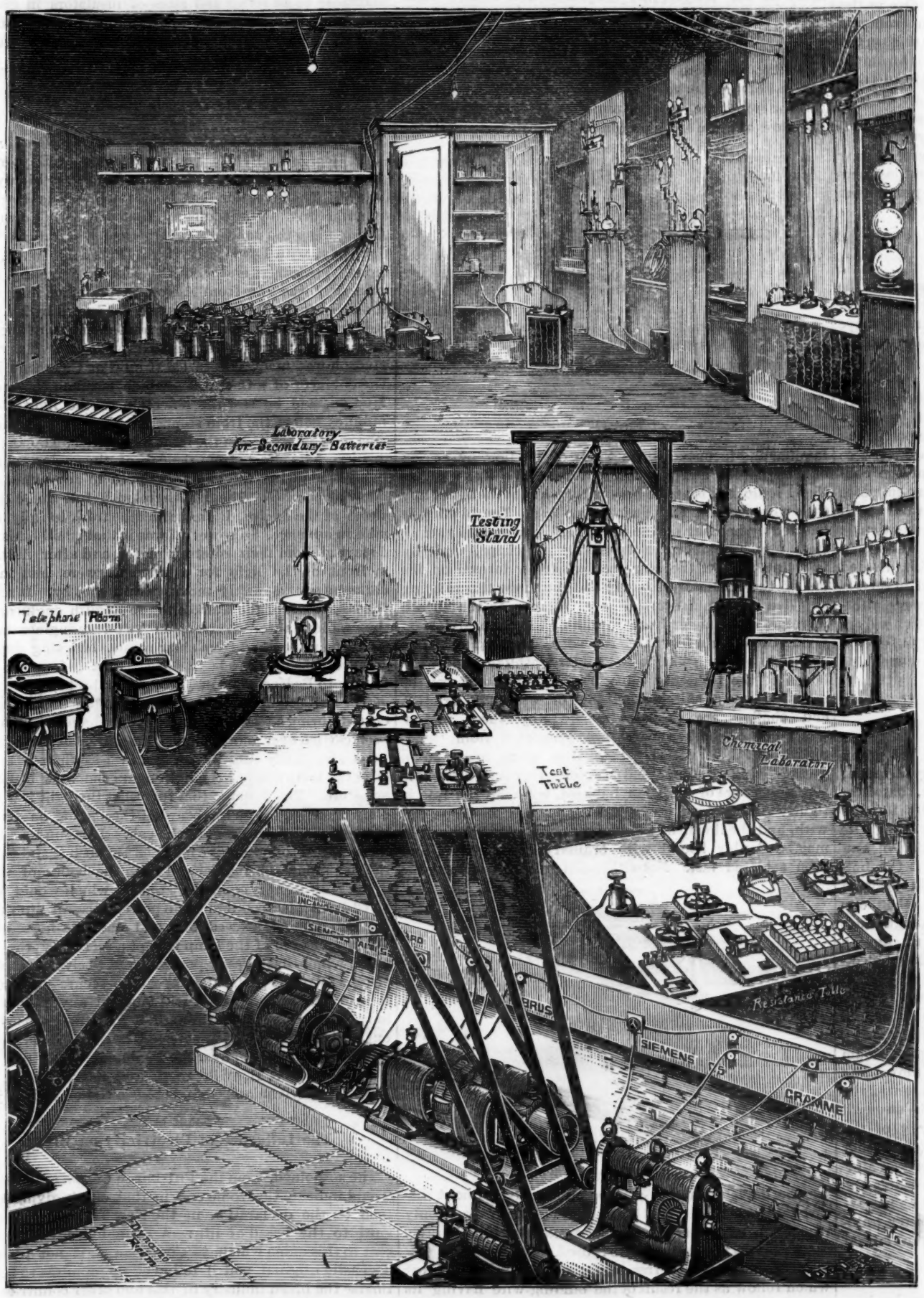
At another table Thomson's Quadrant Electrometer is fixed, together with a variety of other electrical appliances, while at the third table instruction respecting the submarine department is more especially given. The fundamental law of current variation, first formulated by Ohm, and verified by Pouillet, requires to be fully ellucidated, and leads directly to various processes for measuring the resistance and the electromotive force of batteries, in which the student may commence to acquire some skill in "testing." As an example of the proficiency attained in this direction, it may be mentioned that one of the practical problems the student is frequently required to solve, is the determination of the exact weight and length of a wire made up into a coil, of which the ends only are accessible. The principle and use of Wheatstone's balance, the electrometer and the galvanometer, with the mode of taking their "constants," and the measurement of very high resistance by the "fall of charge" in a condenser, next engage attention, and by degrees the student is led on to the more complicated tests for determining the nature and the distance of "faults" in cables, and to various other work pertaining to the advanced science class. For ascertaining slight resistances a Morse galvanometer is supplied. By means of a large commutator it is possible to connect any particular section of a large battery arrangement to any particular table, or to divide the battery into different sections so as to be used at each table, according to what may be required.

On the second floor a suite of rooms is used as a laboratory. Here, besides chemical experiments, incandescent electric lamps, secondary batteries, etc., are manufactured, and the process is gone through by the pupils themselves in the most admirable manner. The practical value of the school as far as the electric light department is concerned, was strikingly illustrated lately on the occasion of an exhibition of the Fitzgerald incandescent light, when all the lamps, and in fact the whole installation, had been made by pupils of the school. In the laboratory can be watched the preparation of the lamps, consisting first in the cutting of the paper into slips ready for carbonizing, the cutting of the copper tubing in order to mount the filament, the completion of the carbon, and the exhaustion of the lamps by means of an air pump on an improved principle.

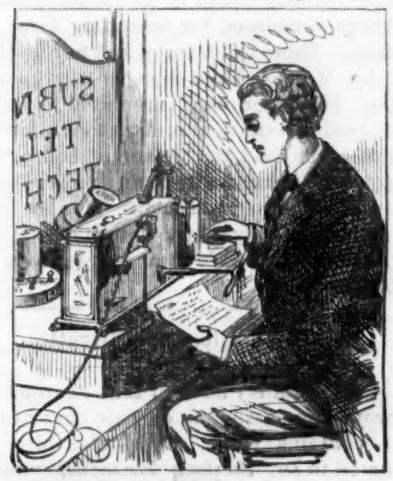
In the telephone department is a variety of interesting apparatus, such as the Pantelephone, as shown at the Crystal Palace, the Gower-Bell, the Berliner telephone, the Blake transmitter, and generally it may be stated that the variety and excellence of the apparatus used are deserving of the highest praise. Visitors at the Crystal Palace Electric Exhibition will remember the tastefully arranged installation made by the school, when many of the appliances were shown. The different arc lamp systems, switches, etc., used, including the Law system, are shown.

There is also a chemical course, and lectures are given on various topics. The electrician when he leaves the school knows something, not only about the chemical changes in a battery, but something of the theory and practice of the steam engine as applied to dynamo machines.

We have said enough to show what the school is and how it fulfills its mission. The opportunity it offers is evidently one to be desired for those who, now starting out in life, and having neither much money nor much time to spare, incline to the electrical profession.

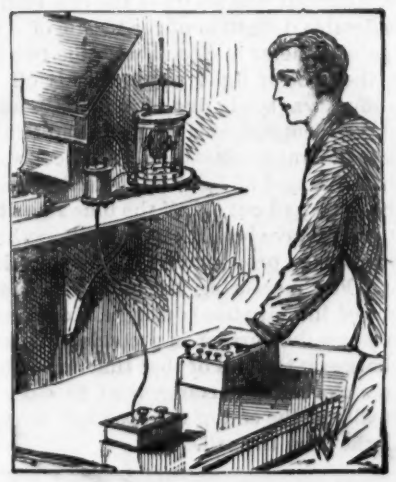


THE SCHOOL OF ELECTRICAL ENGINEERING, PRINCES' STREET, LONDON, W.



SENDING MESSAGE THROUGH MORSE PRINTER.

RECEIVING THROUGH MIRROR AT END OF SUBMARINE CABLE.



TESTING FOR FAULTS IN CABLE.

Music Telephoned Over Telegraph Wires.

Under this head we recorded last week, says the London *Electrician*, the successful transmission of instrumental music from Brussels to Antwerp. Intelligence now reaches us of an opera played in Brussels being heard by the King and Queen of the Belgians at Ostend. Six microphones on the Van Rysselberghe systems had been placed in front of the footlights, facing the performers. Two similar instruments were also fitted, one on either side of the conductor's desk, at the height of the musical instruments in the orchestra; and for future occasions it is determined to add a double microphone in the prompter's box. All these transmitters were actuated by a single Faure accumulator, placed under the stage with the micro-

phone coils, the latter being all mounted in quantity, and really forming but one and the same transmitting instrument. As in the case of the experiments recorded last week, the circuit was formed by one of the overhead wires of the Bell Telephone Company, leading from the central office to the northern terminus, where it joined the State Telegraph line to Ostend Station, which was in direct communication with two Bell receiving instruments, fixed in the drawing room of the royal chalet. M. Berlin, engineer, who had directed the installation with M. Van Rysselberghe, remained at Ostend, while the latter gentleman went backward and forward from the Monnaie Theatre (the Brussels Opera House) to the telegraph office at the northern terminus for watching how the instruments worked. These had been placed in the theatre during the day by M. Mourlon's men in charge of the foreman, Hobé. The experiment is reported to have again succeeded beyond expectation, and on the following day M. Van Rysselberghe had the honor of being received by the Queen, who is known to be an assiduous opera-goer as well as an accomplished musician. Her Majesty spoke of having heard perfectly all the details of the first and last acts of "Faust," and made some suggestions for a permanent installation.

Electric Filtration.

Dr. Dobell lately advised that noxious germs should be destroyed by passing an electric current through the water that contains them. A similar idea appears to have occurred to Dr. Stephen Emmens, who has devised an electric filter, consisting of a glass vessel in which are placed porous vases. These latter contain coal or spongy iron, and also carbon plates connected with the positive pole of a Leclanché battery, being kept apart by other carbon plates communicating with the negative pole. The water to be filtered flows into the porous vases, passes through the coal or spongy iron, and runs out of the containing vessel. Like Dr. Dobell, Dr. Emmens supposes that the oxygen set free destroys all the germs which might render water injurious to health. The invention is also applicable to the purification of sewage waters, in which case the filter takes the form of a conduit, divided by partitions into a series of elements, traversed in succession by the water. The electrodes are wooden cages, alternately filled with pieces of iron and coke. With this arrangement a primary battery is not necessary, for the conduit itself forms a powerful battery, the current of which is more than sufficient.

An Electrical Actinometer.

At the last conversazione of the Society of Telegraph Engineers and Electricians, held at King's College, London, one of the novelties was a new actinometer, based on photo-electric action, which was exhibited by its discoverer, Professor Minchin. The cell sensitive to blue light, consisted of a glass test tube filled with alcohol and having a small quantity of nitrate of ammonia at the bottom. Two electrodes or strips of tinfoil, held in position by the cork, were immersed in the alcohol, and when one of these was exposed to a ray from an ignited magnesium wire, a current was set up in the cell sufficient to cause a considerable deflection of the needle of a sensitive reflecting galvanometer in circuit with the two tinfoil strips. In fact the spot of light went quickly off the scale. That this effect was solely due to the blue or actinic rays of the light was demonstrated by Professor Minchin interposing a plate of orange glass between the cell and the magnesium light. The spot of light was just then seen to move; and if the glass had cut off all the blue rays it is presumed the spot would have been stationary altogether. The strength of current is proportional to the actinic energy of the light. For measuring the effect of sunlight (or another source of illumination) during a fixed time, Professor Minchin stores the current in a condenser, and measures the discharges at the end of that time. To this end he has devised a clock-work arrangement to close a shutter automatically at the end of the specified time, and thus cut off the light from the cell.

To Time Maud S.—An electrical horse chronometer has been invented. The movement is controlled by a current opened and closed by the breaking of an almost microscopic copper wire stretched across the track. It is said to record to the 1500th part of a second.

The Memphis Pan-Electric Telephone Co.—This company is now offering stock for sale at Memphis, Tenn., in shares of $50 each, at fifty cents on the dollar. The company states that it starts with three hundred paying subscribers. The circular issued does not give any details as to the apparatus used.

Long Distance Telephony.—A company of New York capitalists has been formed to establish a telephone line across the Atlantic Ocean. It is to be supplemented, if the patent-rights of the Bell Company permit, by a telephone line from New York to San Francisco. Among the stockholders and directors are Mr. John H. Reed, of the firm of Bates, Reed & Cooley; H. C. Skinner, of Hazen, Todds & Co.; George M. Groves, vice-president of the Bank of the Metropolis; William Foster, Jr., formerly the president of the Metropolitan Elevated Railway Company, and several Boston capitalists. The telephone to be used is the Gillett, described in The Electrical World last April. Our article and illustrations have been reproduced in the pamphlet issued by the company.

Self-Binding, High-Resistance Insulators.

Last April we published a brief but interesting article from Mr. J. F. Kelly, on the subject of porcelain insulators, and mentioning the Lewis self-binding insulator as worthy of more than passing attention. This form of insulator appears to have made great way in England in public favor, and Mr. J. Slater Lewis, of Birkenhead, England, is now in this country to represent the interests of the Patent Self-Binding Telegraph Insulator Company (Limited), a corporation controlling the patents under which his insulators and accompanying devices are manufactured for telegraphic, telephonic and electric light purposes.

We illustrate on this page two of the methods of binding in connection with the Lewis insulator, which, it may be well to mention, though preferably of porcelain on account of superior resistance, can also be if required of glass or stoneware. These insulators made in the general style to which we are accustomed here, dispense with the

Fig. 1.

familiar and inconvenient methods of binding by reason of their special and peculiar details. The line wire, as Fig. 1 indicates, is applied instantly without the use of any tools whatever, in any desired position. The binding is effected by hooking on the line a rigid galvanized-iron or steel clip resembling a horseshoe in shape, and by inserting therein the large conical screw formed on the top of the insulator—the clip and the screw thread being adjusted in manufacture to each other. As the thread increases in diameter from bottom to top of insulator, on giving the latter a few turns it becomes rigidly fixed in its position, and the wire is held in a deathlike grip by the hooks of the tightened clip. The insulator itself can be mounted on a suitable bolt-pin or bracket. Friction and chafing are entirely avoided by these means, while cut or broken wires are prevented from "running back." It will be seen that there must be a great saving of time, and another recommendation is that any gauge of wire can be held, whether the line is tightly stretched or loosely. The clip may be dispensed with, and the line firmly bound in with stout wire, or it may be doubly bound with ordinary binding-wire, and even soldered fast. Notwithstanding this, the Insulator

Fig. 2.

may be detached and re-attached instantly, without disturbing the binder. This latter method, however, is only recommended in very exceptional cases, where hard drawn copper or silicious-bronze wire is used.

The insulator is kept free from the usual streaks of rust which follow as the result of the binding-wire having its coating of zinc cracked off in the process of wrapping or lashing it round the line-wire, by reason of the clip which encircles the insulator being wholly galvanized and undamageable, and in consequence of the total absence of friction and "working" of the wires.

The resistance of the ordinary insulator is considerably diminished through such a mass of thin binding-wire being in absolute contact with the glass or earthenware, forming a great number of small receptacles and crevices which serve to retain damp and dirt; whereas, in the Lewis self-binding insulator, the line-wire and clip only touch at three points, thus raising the insulating qualities of the system far beyond the ordinary kind. It has also shown that oxidation and an injurious chemical action take place more where the binding-wire is wrapped round the line-wire than at any other point, and that, in consequence, breakages occur more through that defect than through any other cause.

Fig. 3 shows a supplementary form of binding for crossings, streets, roads and house-top work. The method is this: Two lengths of No. 16 galvanized iron wire, each two feet in length, are placed side by side, and twisted four or five times round each other in the centre. They are then bent into the shape of a long **U**. The two ends on both sides are then passed underneath the line wire, between the head of the insulator and the hook of the clip. The wire is then pulled through until the twisted portion is fixed, as shown in the cut, close underneath the line. One wire on each side is then twisted round the line for about 1¼ inches on the outsides of the clip, the two remaining wires being twisted in a reverse direction over the first wires, in the manner illustrated.

It would seem that this system, which is practically adaptable to all forms and sizes of insulators in glass or porcelain, has considerable merit; and as in this country a good thing never goes begging for patronage, these self-binders will soon become extensively used.

The Pyle Electric Headlight.

The following is taken from the Cleveland *Herald*:

Mr. George C. Pyle, a young inventor of Dayton, has perfected a headlight that has thus far proved highly successful. The invention has been purchased and will be manufactured by a company that has been formed in Akron under the name of the American Electric Headlight Company, with Lewis Miller for its President; W. B. Raymond, Treasurer; and Leonard Moore, Secretary. An excursion was run from Akron to Cleveland and return last night under their auspices and conducted by Mr. C. F. Stewart, and accompanied by several members of the company. The excursion train left Akron at 6:40. The run to Hudson was made with a short stop at Cuyahoga Falls. The engineer of a C. and P., which stood on the track at Hudson, said he saw the reflection of the light twenty minutes before the train stopped at the station. The persons most interested in the light were given an opportunity to witness its effects from the cab of the engine, changes being made when the engine stopped to accommodate as many as possible. The light streamed full and clear far ahead of the engine, illuminating the track to fully half a mile in advance. So powerful was it that small birds were disturbed from their roosting places, and after fluttering in front of the light for a moment were lost in the darkness as the swiftly moving train shot by. It seemed that the boast of the Yankee to the English engineer that the headlights were so strong on American engines that the chickens were lured from their roosts, believing day had dawned, was about to be fulfilled. Just before the train drew into Bedford, one of the carbons broke, owing to a defect in its composition, the first instance that has occurred during a test of six months, in which the light has been carried over more than 35,000 miles. A new carbon was immediately substituted, and in less than a minute after the train stopped the light again shone as brilliantly as before. The dynamo that furnishes the light is a small affair fastened to the footboard of the engine on the left side and directly in front of the cab. It is run by a three-horse-power rotary engine fastened between it and the cab, the steam power being derived from the boiler of the engine. The light is equivalent to that which would be derived from 2,000 candles. The power necessary to run the dynamo will not exceed one and one-half horse-power. The mechanism of the lamp is kept a secret by the company, which has already possession of twelve patents covering its various parts, and expects to secure still others. It is so constructed that it will burn in any position, as long as a current passes through it and the carbons hold out. The same lamp was tested during the months of February and March, over the Panhandle road, then over the Richmond & Danville road, and later over the New York, Pennsylvania & Ohio, between Galion and Dayton.

The Influence of Electricity on Bread.

The subjoined, from the Pittsburgh *Commercial Gazette*, would indicate that some one in that city is giving a new turn to the declaration in the New Testament, with regard to the bread of life: A communication has been sent to this office which, to say the least, if not quaint, is decidedly original, and if followed up promises to revolutionize the bread industry of this and other countries. In fact, it would seem that there is in store for the people the stern necessity of seeing to it that every man knows his baker, and that the aforesaid man of kneads is a person of good morals, in fact a man after his (the bread eater's) own heart, lest by eating the bread the consumer partakes of the nature of the baker. The communication is as follows:

"I have for some time been studying animal electricity in its various phases, and the result of my investigations leads me to believe that it is possible for human beings to impart electricity to fellow men in ways that would at first thought seem highly improbable. Especially is this possible through the medium of breadstuffs. It fact, it is impossible to eat bread without partaking of the masculine electricity of the baker who kneaded it, and thus in time the consumer takes on the disposition of the baker. The theory of course being, that while shaping the loaves of bread, while yet in the dough, by contact with the same, the baker imparts to it a portion of his nature, which lies dormant in the baking process, but making itself felt in the system of the consumer."

The Drawbaugh Claims.

As we stated last week, the Bell-Drawbaugh suit has been argued before Judge Wallace, in the United States Circuit Court here. It is utterly impossible, even for a daily paper, to report the arguments which have lasted two weeks at the rate of six hours daily, until they have promised to be as long as the evidence, now filling seven thousand pages. Only a very condensed report is given below of the addresses by counsel, bringing out the chief points.

Mr. Storrow, for the Bell Company, said that Mr. Bell had communicated his idea to Prof. Blake of Boston in 1874; he conferred with Prof. Henry about it in 1875, and constructed his first instrument in June, 1875, got his first patent on March 7, 1876, and exhibited it at the Centennial. The Bell instruments went into commercial use in the spring of 1877, and at the time of Drawbaugh's application for a patent were in use all over the world. Prof. Bell, previous to his discovery and invention of the telephone, had devoted his life to vocal science. He had made a long study of the science of acoustics. He conceived the idea of impressing upon the current of electricity the form of waves in the air. Many of his experiments and discoveries were in connection with his invention of the harmonic telegraph.

The complainants allege that certain of the defendants associated themselves together with the intention of making speaking telephones, according to certain improvements patented by Klemm and Tisdell; that they became aware that they could not make those instruments without infringing the Bell patent, and thereupon, searching for a defense, they heard of Drawbaugh, and entered into an arrangement with him to set up and claim that he was the first inventor of the speaking telephone and to make an application for a patent therefor, and afterward caused him to file an application for a patent for a speaking telephone as the first inventor; that Drawbaugh was sought for, not because it was supposed he could furnish a telephone, but because it was hoped he could supply a defense. In 1880, the other principal defendants undertook to make telephones. They were advised that the instruments they were about to make were infringements upon the Bell patent. Then they got from Drawbaugh three-fourths of his pretensions for nothing. These pretensions were sold for $20,000 in money and an unknown amount in stock. Then followed an application for a patent and a corporation with $5,000,000 share capital. The chief man in these negotiations was E. M. Chillis, who kept a 99-cent store in Harrisburg, and was a man of a speculative turn of mind. The complainant relies much on the allegation that Drawbaugh never produced a practicable telephone of any value to the public, but that his invention was only used from time to time experimentally in his own shop. The complainant's brief asserts that during the time between Drawbaugh's alleged invention and the Bell patent—say ten or eleven years—Drawbaugh took out four patents. He received $10,000 for his patents. He owned his house, had the use of a well-equipped machine-shop, and exhibited at state fairs, but did not exhibit telephones. At the time Bell was exhibiting his telephones at the Centennial Exhibition, Drawbaugh says he had five or six sets of practical speaking telephones. But he did not even mention the subject to his neighbors who went with him to the Centennial. The claimants allege that even the imperfect success which was had with Drawbaugh's instruments was a false test, because these instruments were not, in fact, the same as those actually used by Drawbaugh, but were much improved and composed partly on the plan of Mr. Bell's invention, which had at that time been in use six years. Mr. Storrow called attention to the fact that most of the sentences that were heard through the Drawbaugh telephone were very common sentences, and urged the improbability of Drawbaugh's story that his telephone was used by ordinary farmers, who could readily hear through it.

He said that the defendants had claimed that Drawbaugh's invention had been common talk at Eberly's Mills for seven years prior to 1872, but Henry Drawbaugh, the inventor's brother, testified that until 1872 he had not heard of the telephone. Why had not Mrs. Drawbaugh been called to the witness stand, and why had no drawings been preserved by Drawbaugh?

Mr. Storrow said that, for this remarkable failure to apply for a patent, there had been but one explanation offered, and that was the poverty of the defendant. He proceeded to array before the court the evidence of the complainant as to Drawbaugh's resources, claiming that it entirely answered and overthrew the plea of poverty. He produced and handed to the court a card of Drawbaugh, stating that he was an "inventor, designer and solicitor of patents;" also bearing the words "models neatly made to order." On the other side of the card was a list of inventions made by him, in which the telephone does not appear.

A Mr. Stees, of Harrisburg, had a Bell telephone in the spring of 1878, and was dissatisfied with its working. Mr. Storrow said: "Drawbaugh in that spring went to Mr. Stees' office and tried a commercial telephone. Mr. Stees had the usual faculty of grumbling at what was furnished to him by everybody, and he went on one occasion to the office of the Western Union company and said to them, 'Well, Dan Drawbaugh is getting up a telephone that is going to beat you.' Now, Mr. Stees had known Mr. Drawbaugh for 10 or 15 years, had been concerned with him in some enterprise, got up a stamp pencil in 1865, and that was the remark Mr. Stees had to make then, for whatever it was worth. Presently he took Drawbaugh to the telephone office and introduced him—not as an inventor of a telephone. He introduced Mr. Drawbaugh and said, 'I should like to look at the telephone.' Mr. Stees said, 'Will you let him open and see the inside?' (Exhibiting a telephone to the court.) This is the patent; what is known as the snuff box, with the mouthpiece off at one side. This is the one they showed him. He opened it and looked inside. At that time, when he opened it, he had with him that instrument (exhibiting to the court another instrument), and one cannot but see a certain resemblance between the two. He had this with him, which, according to his story, he had had for four years, and he said to the telephone manager: "Is yours patented?' 'Yes,' says he, 'mine is.' 'Then,' says Mr. Drawbaugh, 'mine is most too much like it.' The next thing he did he went, not long after, within a few weeks or a month or so, again to the telephone office, and would they do him the favor to loan him one of their instruments, which they did. He took their instrument, carried it to his shop, said he wanted to study and examine it, kept it a fortnight and brought it back again. Now, if his story is true, he had had for four years, yea, for 10 years, instruments which put those all out of sight. If his story is true, he then had at his office, in his shop, microphones which exceeded anything thought of before that. But he went through that experience, and never said to anybody concerned in that office, 'Why, I am the man who had these things years and years and years.'"

Mr. Storrow commented at great length on the negative testimony, *i. e.*, the testimony of men who would seem to have been sure to have seen the early telephone inventions of Drawbaugh if there had been any to show.

The defence of Judge Lysander Hill, which alone would fill about one hundred columns of this journal, was of the following tenor:

In discussing the question of fact it is necessary to determine: First, the date of Bell's invention; secondly, the date of Drawbaugh's invention. First, it appears from Mr. Bell's sworn preliminary statement, filed in an interference with Edison and others in the Patent Office, that on June 2, 1875, Mr. Bell for the first time conceived the practical possibility of the transmission of articulate speech by a membrane instrument, which was completed July 1, 1875, and another a few days after, and with these instruments Mr. Bell and Mr. Watson experimented in July, and at the end of that month discontinued their experiments, without having heard a word of speech through the device, and even without Mr. Bell having been able to hear a sound, and that no further experiments were made until March 10, 1876, after the date of Mr. Bell's first patent, which was issued March 7, 1876; but that on March 18, 1876, experiments were suddenly resumed, not with the instrument of July, 1875, but with a liquid transmitter, and then for the first time was obtained, to use Mr. Bell's words, "intelligible articulation." Watson swears positively that he never understood a word through any telephone apparatus until March 10, 1876. Hubbard corroborates them both, which disposes of the question. It is a significant fact that Mr. Bell, in his public address in England giving the history of his invention, made no reference to this first transmission of articulate speech ever secured by him, to wit, on March 10, 1876, by means of a liquid transmitter, although the fact is established by his evidence and by Watson's written memorandum, made at the time. It is also a significant fact that the very day Bell filed his application, Feb. 14, 1876, and before he had transmitted any articulate sounds, Elisha Gray filed a caveat in the Patent Office for an invention transmitting articulate speech by means of a liquid transmitter, a method which Bell had never previously tried. An interference was declared and Bell notified, but his attorney availed himself of a pretext that Gray's caveat was filed two hours after Bell's application, persuading the Commissioner to divide the day into fractions and dissolve the interference. Bell testifies, however, that he went to Washington at this time, between Feb. 25 and March 7, 1876, and had an interview with Patent Office Examiner Wilbur, who had ordered the interference, and what passed between them at that interview is unknown, but Mr. Bell admits that he carried away from that interview the impression that the conflicting point was in reference to the "vibration of the conducting wire in mercury or other liquid," and that he knew that this caveat "had something to do with the vibration of a wire in water." He immediately returned to Boston, summoned Watson to his aid, and resumed the experiments so long discontinued, and by the very means of a liquid transmitter, set forth in Gray's caveat, forthe first time in his life transmitted articulate sounds. The drawing of apparatus, made by Mr. Watson and put in evidence, corresponds closely, in principle, mode of operation and means employed, with drawing attached to Mr. Gray's caveat. Having accomplished by this means the transmission of articulate sounds for the first time, he subsequently produced the same results by a magneto apparatus. This date of March 10, 1876, is of importance, because the complainants of necessity frankly admit in their argument that instruments D and E, made by Mr. Drawbaugh, were good working telephones, containing in every respect the invention which is subject to controversy, and, so far as the mechanical construction is concerned, fully anticipating the patent, and their expert, Mr. Pope, has admitted in evidence that they are to-day good working apparatuses, and the evidence shows clearly, and it is in the most satisfactory manner proved by a large number of witnesses, that these instruments were made by Mr. Drawbaugh as early as January, 1875, and the original instruments, not reproductions, are in evidence and here in court.

Secondly—The date of Drawbaugh's invention. It should be observed that the complainants, in their efforts to show Drawbaugh's earning capacity during the period embraced in the discussion, have unavoidably been compelled to admit his mechanical ability, his inventive capacity, as evinced by the vast number of inventions that they have specially enumerated. For purposes of their own they have dwelt upon the vast amount of attention he devoted to electrical subjects and electrical inventions during many years past, such, for example, as his electrical clocks, run by currents of electricity generated in the earth; his magnetic telegraph key, invented by him years ago, which operates by the approach and recession of a magnet to an armature, creating pulsations of electricity in the wires without the use of a battery—a recognition of a grasp by Drawbaugh, and possession by him at an early date, of one of the fundamental principles underlying the working of a telephone. Couple this with the testimony of Prof. S. H. Herges, principal of the State Normal School of Pennsylvania, that prior to the spring of 1860 he delivered a course of lectures on physics, including electricity, near Milltown, which Drawbaugh attended, that Drawbaugh at that early date said to him that he contemplated the transmission of speech through a telegraph wire by electricity, and believed that it could and would be accomplished, and the theory of "inherent improbability" advanced by the complainants is hardly tenable, especially when we consider that Mr. Bell entered upon his work without any special knowledge of electricity, and was advised by Prof. Henry to get that knowledge. Even complainants' own witnesses testify that Drawbaugh was an inventive genius. "He was a great mechanical genius" (Worley). "He was a great inventor; I know that" (Edward Nichols). In Wing's History of Cumberland County, Pa., published in 1879, introduced in evidence by complainants, he is referred to as "an inventive genius of whom our country may feel justly proud." Dr. C. E. Updegraff testifies that "the subject of electricity seemed to be his hobby;" and this is confirmed by all the witnesses in the case, both for complainants and defendants. That Drawbaugh, between the years 1860 and 1868 entertained the idea of transmitting speech by electricity and experimented to that end, is shown not only by the testimony of Prof. Herges, but by the testimony of Henry B. Eberly, W. M. Long, Samuel H. Bates, Mary M. Daw, James A. Smith, postmaster of New Cumberland, Pa., and dates are fixed by these witnesses by various circumstances that can leave no doubt.

Judge Hill then went over the evidence of a great many witnesses, dating back their acquaintance with the Drawbaugh instruments (illustrated in this journal in issue of April 12, 1884) to the years 1867–1875, between and inclusive. In reviewing the whole of the evidence, he said, it appears that 197 persons testify to knowledge of Mr. Drawbaugh's speaking telephone prior to Feb. 14, 1876. Of these, 126 actually saw the instruments, and a majority of them identify the particular machines which they saw; and over 60 heard talk through the machines or were present when others were successfully talking through them. The great majority of these witnesses testify to the fact occurring prior to June 2, 1875, and, therefore, anticipating Bell's first alleged telephone experiment. The history of Drawbaugh's telephones subsequent to Feb. 14, 1876, affords a strong array of additional testimony, corroborating the above evidence. There is abundance of testimony showing that Drawbaugh from time to time applied to men of means offering them interests in his "talking machine" if they would help him to patent and introduce it. For example: Christian Eberly, Mr. Herr, of Harrisburg; Henry F. Drawbaugh; Henry Snyder, of Newville, Pa.; Henry Dayton, of York, Pa.; Thomas Draper, of Dover, Del.; Jesse Eicholtz; E. W. Chellis; Dr. J. W. Moffitt, of Harrisburg; Capt. J. A. Moore, Wm. R. Gorgas, Jacob E. Scheptel; Elias Graybill and others, most of whom looked upon it as a mere toy without any practical utility, and none of whom appreciated its commercial value. Drawbaugh's great poverty between the years 1868 and 1878 is clearly established by every variety of testimony, including that of his neighbors and of sheriffs and constables who returned executions unsatisfied, and from a variety of other circumstances. Some of his neighbors and friends called him crazy, and others a fool for devoting his time and attention to such a mere curiosity as a "talking machine." In a word, it is conclusively established, as far as any human testimony can establish any fact, that, on the morning of June 2, 1875, Alexander Graham Bell and Daniel Drawbaugh stood relatively as follows: Mr. Bell had discovered nothing and invented nothing; he was ignorant even

of the fact that the mechanical vibration of an armature in front of a pole of an electro-magnet would cause any audible effects at the other end of the line. He was not an electrician, and was groping for general information as to the character and effects of an electric current under different conditions. He suspected the possibility of electrically transmitting speech, but had no idea of the means for accomplishing it. At this samemoment Mr. Drawbaugh had in his shop at Milltown at least seven electric telephone instruments—transmitters and receivers, battery and magnet telephones, through some of which he had been successfully transmitting speech for years, and all of which were open to the inspection and trial of any person who chose to visit his shop. If Mr. Bell had visited Drawbaugh's shop that day he could have heard conversation back and forth over an electric speaking line as perfectly and as easily as to-day. And these facts, so far as Drawbaugh's telephones are concerned, were known at that time to whole communities—not to a few interested persons, but to hundreds of witnesses scattered over a wide territory, and some of them living in distant counties, and even in distant States. The conclusion is inevitable that Mr. Daniel Drawbaugh, and not Mr. Alexander Graham Bell, was the first and original inventor of the telephone; and this is established by an array of witnesses far surpassing, comparatively, the meagre evidence under which the Supreme Court overthrew valuable patents in the leading cases of Gaylor vs. Wilder and Coffin vs. Ogden, previously cited.

Senator Edmunds followed Judge Hill in behalf of Drawbaugh. E. N. Dickerson, of counsel for the Bell Company, began his closing argument on Tuesday, the 30th ult. Mr. Dickerson used up the forenoon in denying the charge made by ex Judge Hill, of counsel for the People's Company, that the Bell Company had not done fairly with the testimony of witnesses living at Eberly's Mill. Then Mr. Dickerson turned his attention to some of the testimony taken by United States Commissioner Ott, and argued to show that Drawbaugh had been very greatly overestimated, and had deceived the people of his neighborhood not only by his telephone inventions but by the inventions of various things which he had foisted upon a credulous public. In the opinion of Mr. Dickerson there seemed to be little irregular and unfounded that Drawbaugh would not do. "Drawbaugh for years made his living as a professional impostor," said Mr. Dickerson, striking the railing in front of him to emphasize his point. "He made his living by professional imposture just as much as the bunko steerer makes his living in this city by bunko steering. Drawbaugh established by 30 witnesses," said Mr. Dickerson, "what he knew to be a falsehood, and that's the kind of evidence that our learned friends on the other side wish us to take as facts." Mr. Dickerson spent the afternoon in showing that Drawbaugh's hydraulic ram, which was said to have been built in 1876, had no existence until 1878, and in casting legal doubt upon the arguments advanced by his learned friends on the other side.

Argument in the case of the American Bell Telephone Company against the People's Telephone Company was finished on the 2d inst. by Mr. Dickerson. He referred to the testimony of several witnesses to show that Drawbaugh, while being a professional impostor, was not so poor a man as had been represented. Drawbaugh had been associated at one time, it was claimed, with ex-Gov. Geary, of Pennsylvania, in the manufacture and sale of rotary pumps, and had received $6,000 for his invention. With part of this money a new house was built, and was furnished with no fewer than 17 wagon-loads of furniture. Judge Wallace took the papers and reserved his decision.

Electric Lighting Interests in Boston.

An important meeting of the full board of the directors of the American Electric & Illuminating Company was held on Oct. 1 at the offices in Boston, when a close and thorough analysis of the affairs, operations and prospects of the company was gone into. The result was satisfactory in the highest degree. Both the finances and the business were found to be in an admirable condition.

Owing to the rapid increase in the business operations, it was decided to establish several departments of work, the head of each to have full authority and to be held responsible for all that concerned it. The steam power, engineering, etc, of all the plants to be constructed by the company, will be in the hands of Major L. B. Wright, the mechanical engineer of the company. The important work of the introduction of isolated plants into mills, factories, etc., will be intrusted to Mr. H. W. Burgett, manager of the isolated plant department. The accounts of the American Company and of all its sub-companies will be supervised by Mr. F. Montague Sowdon, the auditor, and the finances of the parent company will be under the charge of Capt. J. C. Irvine, brother of the late treasurer, and one who, having had much experience with the company in the past, now returns as its treasurer. It goes without saying that Mr. Edward H. Goff retains his general supervision of all the affairs of the company as its president. Mr. C. D. Smith, who has been associated with him from the start, holds his position as general manager. With this remodeled and perfected personnel and organization, the company may look forward to even greater prosperity than has been experienced by it in its rapid advance hitherto,

National Conference of Electricians.

FOURTH DAY—SEPT. 11, 1884.

We give below the conclusion of Thursday morning's proceedings, and reproduce some of the earlier cuts for convenience of reference.

Prof. Francis J. Fitzgerald: Mr. President and gentlemen, I feel that I have to apologize to you for having been led into the question of the effect of self-induction; and I have partly to apologize for not having had sufficient energy to investigate this thing very carefully, and that my information upon the subject is not brought as distinctly to mind as it might have been. The warmth of the weather and the incurable hospitality of the American people have not left me time to investigate the matter.

The point which I was led to call attention to frequently some years ago, and which has been investigated and experimented upon by several, is this: Taking a coil in which the current is being started from there to there (a to b, Fig. 13); the current is going in this direction (small arrow) and the ring is turned in that direction (large arrow); when the coil was at that side (d) the current was running down through it in that direction (arrow) as soon as the current passes across the brush at b it is reversed, the current passing off. Consequently the current which was at one time running in one direction, is reversed so as to cause the current to be running in the opposite direction. That in itself necessitates no loss of energy. The work that is to be done in stopping the current and turning it in an opposite direction does not in itself involve any loss of energy if energy in stopping the current could be utilized in starting it again. If you could use the energy which is necessary to stop the current to start a fresh current in the opposite direction, there would not be necessarily any loss of energy in your arrangement; but what I want to call attention to is this; that in general a coil is short-circuited when it is passing from one of these positions to the other across the brushes, and consequently the energy in stopping is used in sending sudden and short currents through itself. There is in general a circuit through the coil, which is in short a short circuit in itself, and the energy of the coil which goes out in stopping is not used in starting the current in the opposite direction. Therefore you have lost the energy of the coil due to its own induction through a short circuit.

The loss of energy due to this cause for this coil will be proportional to the induction and the square of the current passing through it. If M is the induction of each coil, and C the current passing through it, MC^2 is the loss of

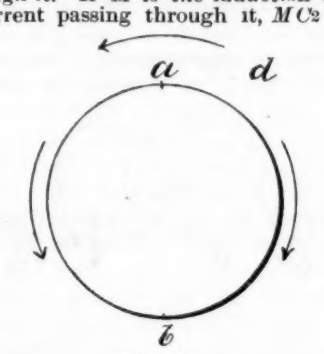


FIG. 13.

energy due to the self-induction of the coil being wasted on the local current. This will be on each coil; hence, if N were the number of coils that were passed per second, MNC^2 would be the loss per second owing to this fact. This can be put into another form by substituting for MN the terms of the self-induction of the unit of length of the ring. If V is the velocity of the edge of the ring, and L is the self-induction per unit of length on the ring, then necessarily $VL = MN$; and VLC^2 will represent the loss of power owing to the self-induction of the coils. For a given ring it varies directly as the linear velocity of the ring. It was a very difficult thing to make experiment upon this effect as to whether there was any loss of power due to the self-induction of the ring. The term VL is in the nature of a small resistance which we may call R, so that the loss may be written RC^2. This is a resistance of the machine due to its velocity and is proportional to the linear velocity and the self-induction per unit of length. The resistance of the ring is easy to obtain by rotating the ring under the action of the earth's magnetic force. One great difficulty was to get an arrangement in which there should be no reaction between the magnetic field and the ring itself. Field magnets were therefore used instead of the magnetic force of the earth, and consequently there could be no reaction from induced magnetism in the earth owing to the magnetization of the ring. It was therefore assumed that the initial magnetic field was constant. That is the difficulty—to determine the reaction between the magnetism of the ring, and the induction which would be occasioned on the field magnets. A number of experiments were tried, and it was found that as far as the experiments went there was an increase of resistance owing to an increase of velocities, and that it was approximately proportional to the increase of velocity, and that it was approximately equal to what it was calculated it should be. It was found that the increase of resistance was a little larger than this amount; but it is almost impossible when turning a Gramme ring rapidly to prevent the jumping of the brush upon the commutator. The result of the experiments, however, led to the conclusion that the increase of resistance was to be calculated upon, and that there was a reason for not running dynamos any faster than a certain amount; that there was a certain velocity which it was well to not drive them at, because this internal resistance varied as the linear velocity of the ring. You can get over this resistance due to self induction by constructing what are called unipolar dynamos.

First of all I may say something of the effect which Prof. Rowland called your attention to—the effect of size upon this apparatus. In the first place the angular velocity is inversely as the square of the linear dimensions. Therefore the linear velocity will vary inversely as the linear dimensions. Consequently the effect due to this linear velocity would be less in the larger machines, not more than half that of a machine of half the size.

The effect of the self-induction per unit of length of the ring will be independent of the size of the machine. For the co-efficient of self-induction is in general proportional to the linear dimensions of the system. The co-efficient of self-induction is in general of the dimensions of a line, and therefore the self-induction of a unit per length will be independent of the dimensions of the system. Consequently you will get this: the increase of resistance is inversely proportional to the linear dimensions. Inasmuch as the increase of resistance will be inversely proportional to the linear dimensions, and inasmuch as the current varies as the linear dimensions, you have that the loss of power will be directly proportional to the linear dimensions.

The whole power is directly proportional to the linear dimensions, so that the proportion of the power lost to the whole power will be constant and independent of the size of the machine.

It is possible by constructing what are called unipolar dynamos to get over this loss owing to the self-induction. For instance take the simplest case of Faraday's experiment with a magnet rotating. In that case there is evidently no sudden change in the current. The current is gradually diminished. There is no sudden alteration in the current; it is a uniform action, and consequently there will be no loss in this case so far as I can see owing to the increased velocity at which it goes. You will have here the self-induction of the current diminishing, and helping to increase the current at some other point. Hence there will be no loss due to the stopping and starting. Some people find difficulty in understanding how there can be no loss in an opposing force. It is the case of a crank running upon a wheel, there is no loss owing to the reciprocation of the crank, the mechanical force that is required to start it at one end being given out at the other end. But in this case it is like a bad crank, which joggles upon its bearings; and in this case there is a loss by the reciprocation of the action.

In this case we have the loss due to short breaks, and in that case there would be a loss, owing to the increased pressure of the crank on the bearings. In every check of the crank there will be a loss, and hence in this case there will be loss, owing to the fact that you have to change the current from one direction to the other. But in this case of the unipolar machine it is like a crank axle in which the motion goes on uniformly without any unnecessary joggle round and round. Therefore there is no loss due to self-induction.

It is possible, also, to arrange Gramme armatures in such a way that there would be no loss owing to this cause, by arranging them so that there shall be a number of different brushes and the current divided between these different brushes. The easiest way in which I can explain this is by taking the case of two Siemens armatures, the current being divided between them, part to one and part to another. Now, it is evident that it is possible to arrange the brushes in a certain position so that the brushes themselves shall make a contact in this armature at the time when the electromotive force is exactly the same as the electromotive force that is required to be sustained between those two wires, whereby the potential at the ends of the armature is the same as at the ends of the two brushes, the potential of the brushes being kept up while this contact is being made at the armature, so that you can make the contact with the brushes when the potential of the brushes is the same as the potential of the armature, and therefore there will be no tendency for the current to start or stop at that time through the armature, and therefore it must start gradually. On the other hand it is evidently possible to arrange the electro motive force so that at the instant of turning it shall be able to stop the current in this direction, but not to drive the current in the opposite direction; thus driving the current in this direction during a part of the revolution and in this direction during another part. During the intervening time, it is evident that there will be some instant in which there is no current running in this armature. If that is the moment which is chosen for breaking the current there will be no spark owing to the self-induction at that time. So that by making the contact between the brushes and the corresponding commutator at the time when the potential of the brushes is the same as the end of the armature, and when there is no current running in that coil, you will necessarily have a machine in which there is no loss in this way owing to the sudden breaking and stopping of the current.

I would just like to say something in connection with the question that Prof. Rowland mentioned upon another point, and that is, that in a large dynamo you have got an obvious advantage; that it is possible to make the clearance very much less in proportion than in the small dynamo.

You can make the angular distance between the armature and the poles very much smaller in proportion in the large dynamo than in the small one, owing to the possibility of making the clearance much less. Another advantage in the large dynamo, on account of the electromotive force being nearly the same in the two dynamos, you may make the proportion between the area involved in the insulation and the area of the conductor smaller in the large dynamo than in the smaller one. It would not be necessary to make the area of this armature proportional to the linear dimension, consequently you can have a much larger conductor in proportion in the large than in the small dynamo; so that that is an additional advantage you can have in the large dynamo.

With reference to the centrifugal force. While I was waiting, I worked out a little point that I would like to draw attention to, and it was with reference to the Gramme ring. I have come to the conclusion that the tension of the material and the wires, per unit of area, will vary directly as the square of the linear velocity; and that therefore the velocity being inversely proportional to the linear dimensions, the tension per unit of area will vary inversely as the square of the linear dimensions; and that therefore you may drive the larger Gramme ring considerably faster than you could the smaller without any danger of its flying to pieces. I think the tension of the ring is exactly proportional to the square of the linear velocity. But I am not sure. I am sorry that this is all I can give you upon the subject.

Prof. Elihu Thomson: Mr. Chairman, I have been at work on dynamo machines for a long time, and my experience teaches me that some of the statements made are not correct. For example: there is a factor that has been omitted in regard to the extension of poles of magnets. We have a figure showing an extended pole piece, under which an armature is revolved. It is stated that the lines of force find it easy to go this way (arrows, Fig. 5). I do not think so. We find, on examining the machine during its motion, that the armature itself is a magnet of an opposing character, that it produces poles which are oppos-

ing the magnetism of the field poles, and if the armatures are of uniform size and section throughout, that the magnetism developed here in opposition to the field of magnetism will be same as here (indicating). Consequently, you have an opposing force to the field magnet at this point greater than it would be there (indicating), and, consequently, you have again produced a loss of magnetic force by going this distance.

Another fact, and this is what may happen very readily, there is a field running up the side of the magnet and turning in again. By the extension of the poles, carrying your magnet along here, you will obviate to some extent that difficulty.

Then we had the statement made that one set of magnets is better than two opposing sets, as in certain well known forms of machines. I would like to take exception to that also, and for very simple reasons. Take away one magnet and you give every chance for this kind of action, and taking into consideration the fact that the armatures are crossing the magnetism of the field magnet when it is revolving, it becomes extremely simple to see. Place another magnet here (*a*, Fig. 4), and you force the magnetic lines through the armature and you consequently have a much better machine. That leaves out of consideration the fact that you have a small plate of material (of only two and one half or three inches thick in case of Fig. 3) in proportion to the magnet, which has enormous reaching power, if you may choose to call it so. We have an iron plate here (*a*, Fig. 3). Now, taking into consideration again the enormous currents that are developed in that armature opposing the magnetism; that it passes the magnetism of the field down through the armature, you see what a short-circuiting of the field of the armature is made when the iron plate is put in any sort of proximity to the ends of the field poles.

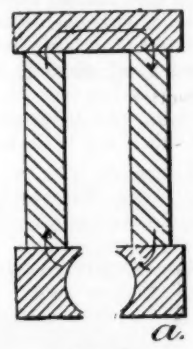


FIG. 3.

Again, take the form of the machine where we have the field magnet in two pole pieces, and we bring the iron down the side to close the magnetic circuit; we bring the piece out in that manner (Fig. 6). The question arises (I have not investigated the subject fully) whether the loss by magnetic short-circuit will be made up in part by the external magnetization of the coil upon the iron in this direction (dotted lines). In other words, by removing the

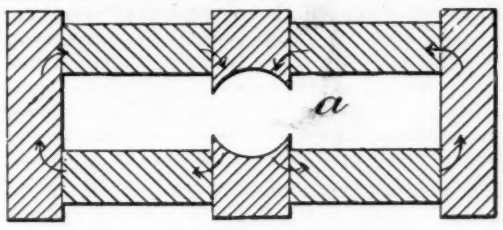


FIG. 4.

iron, not too far away, and again not too near, whether you do not get an external magnetization of the iron lying close up to the exterior of the coil, which would make up for part of this loss by short-circuiting from proximity of iron to the field pole.

With regard to the use of long or short magnets in

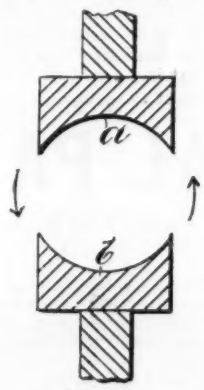


FIG. 5.

the dynamo, if we take into consideration what I have just stated in regard to the magnetizing power of the armature, it will depend upon the diameter of the armature, and the length of the magnetic conductor that is in the armature. Assuming the armature to be made up of radial bars or even discs, the length of magnet you will have to employ will depend upon the opposing magnetic effect of the armature. And I may say also, to the distance between the field magnet and the armature. If you wish to get reaching power or depth of field, in order to reach any distance through the armature, the iron being far away, you will have to use long magnets. If you have an armature which has long projections making an approximate contact, you can use much shorter magnets with equal results.

In regard to the use of steel magnets: It is well known that steel in no condition can accept as much magnetism as soft iron, and it is also well known that if you harden the exterior of a magnet having soft-iron interior, that the radiation to the soft iron interior of the magnetic lines will cause a short-circuit of magnetism through the interior of the magnet. So I do not think we can look for any improvement over soft iron for field magnets. There are many other considerations that might be noticed which show economy lies in using soft iron only, where we wish to get the greatest available magnetic strength.

I cannot agree with either of the gentlemen who preceded me in the statement that there is dead wire in the Gramme armature, or in any other armature that incloses a magnetic circuit. If that was the case, then all wire upon bobbins would be dead wire. We could not produce a dynamo machine which had bobbins in it (for what is the Gramme ring but a series of bobbins), which when they pass the field poles—those bobbins are magnetized there in that manner just as they are in the old Holmes and Alliance machine—when they pass from the position where they include the greatest number of lines of force, pass from the position of saturation to the position of less saturation; they go over to a position where the saturation is reversed. What suggests the reason that the outside of the wire would be more efficient than the inside wire is simply because, as I look at it, there is a tendency that is unrestrained, for the armature to kill itself while it is passing at this point (indicating). There is a tendency of the armature to magnetize the magnet, making a closed circuit on the inside of the ring, which diminishes the effect of it on this wire. However, this closing of the magnetic circuit on the outside of the core causes the field magnet to lose control of the direction of lines of force. This closure of the circuit on the inside of the ring, however, is simple and easy to take place, because here the iron is practically removed from the powerful control of the field magnet, and the coils are where they can act as magnet coils to close their own circuit. How can we increase the efficiency of such a machine? Evidently we can prevent that closure by putting some more magnetic material there.

There is an effect in such machines to which attention has not been called. It is that we can take the same sizes of wire applied to a larger machine and exhibit a real and theoretical increase of efficiency. I hold, however, that theory, when it is true and complete, always coincides with true and complete practice; there is no intermediate stopping point. If you take into consideration every variable, you are bound to arrive at the complete practice; you cannot have one thing theoretical and the other practical. It has been proved mathematically, and it is very easy to go over the ground, but I will not take your attention now, that if we use the same size of wire on armature and field we have the power of the machine increased as the fourth power of its linear dimensions. But if we attempt to apply that in practice, we find this: that the surface of the machine clearly increases as the square of the dimensions, whereas the cubic capacity — in other words, its power to retain heat—increases as the cube of its dimensions. The result of that is that in a large machine you will have to provide a greater amount, proportionately, of cooling surface, or enlarge the size of the wire. The power of the dynamo run for series lighting (I may say I have only determined it approximately) increases as the cube instead of the fourth power of the linear dimensions.

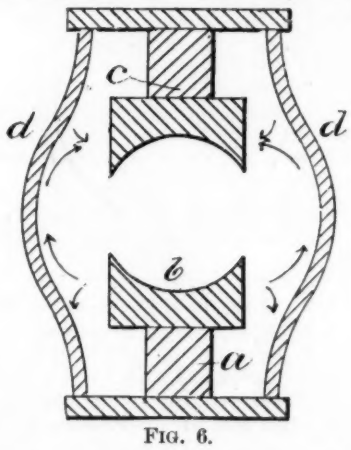


FIG. 6.

In the study of the Gramme armature and its method of commutation I think we have yet to learn a great deal. I cannot see any reason why in the Gramme armature during the commutation there should be any loss at all. Let us figure the ring and study the action of commutation. A coil goes out and comes upon the commutator, passes it and returns, and so on. I hold that the period of contact is such that if the brushes upon these segments are properly arranged there will be no loss; in other words, the time of contact that must exist between these two segments and the brush will be the time that it takes for the coil to lose its current; the commutation must not occur at any other time than when the coil is ready to lose the current and acquire current in the opposite direction of the same amount it is to take when the break shall be made. I do not know that I have made that perfectly clear, but I will go over it again. If the contact remains for a sufficient period to allow the coil to lose its current and the commutation is only being made while it is running down in electromotive force, and continues until the current rises on the other side, until it is fit to go into the circuit; in other words, until it just conducts the current that the other side demands, you will have no loss from commutation. Make it just at that period, and where is there any loss?

In regard to the resistance of armature coils, I think there is an effect that is generally omitted in considering dynamo machines, and it is this—that we cannot consider the measurements of the resistance of the armature at any time as the working resistence. We cannot measure it in any position and let that be taken as the resistance of the armature coil when it is working. Why? Because in any dynamo that furnishes us continuous currents we will have this condition sometimes existing. That is, in the Gramme we have constantly two series of coils; in the Brush, two series of coils, put in multiple arc at times. If you measure the machine while not at work you take it for granted that the current when the machine is running will be equal in those two branches. Will it ever be equal in those two branches? The energy developed by that armature will depend upon whether the current divides equally for the time being. In other words, whether the ring is equally balanced, or whether the brushes are of equal temperature, or whether the armature is put at the centre of the field. The wire will become more energetic if it is nearer the field pole than the under side, and the effect will be that you are sure to displace your commutator brushes. More current will pass through one side than through the other, and you will have more heat developed in one than in the other, and you will not have a perfect dynamo. You will have more energy consumed in that dynamo; and I may say that there i not a machine that I do not regard as coming under that condition. You measure the resistance of the machine when still, and you will not have the same resistance when running it, because the currents do not divide as in still resistance.

That is about all I have to say in regard to the subject under discussion, except that if I have an opportunity I should like to call attention to a number of other matters that affect the working of dynamos. These matters have been derived from studying dynamos and making very many types of machines and experimenting with them, my whole time being almost entirely devoted to their study.

(The conference here adjourned until 3 o'clock P. M.)

The Electrical Development and Manufacturing Company.

It is with peculiar fitness that a company like the above should begin operations just as the Exhibition at Philadelphia has shown the urgent need that exists for something of the kind. The great fact impressed upon the mind as one walks through the Exhibition and examines the various displays is that electrical appliances have passed beyond the stage and the time when single workmen can construct them or single inventors struggle, secretly and wearily and unaided for years, to make an application of some new or old principle. The Electrical Development and Manufacturing Company have at their fine premises 197–205 Congress street, Boston, Mass., not only a splendid plant of machinery, but every requisite in the shape of instruments and supplies for the testing or perfecting of an invention, and its manufacture on a large scale. The company say to an electrical inventor: "If you have anything that you think is good and has promise in it, bring it to us. We offer you every facility for trying its merits, and you can have the opinion of our legal and electrical experts on it. We do not proffer this help on any philanthropic basis, but as a matter of business. You can secure yourself in every proper way, while we expect only a legitimate return on the investment we have made in working up and developing for you the invention submitted. In case the possibilities warrant it we will arrange for the manufacture of the article and for placing it on the best market, so that early troubles and uncertainties and losses will be avoided and the reward made sure." That, practically, is what the company say to the inventor, and, looking at the history of the electrical inventions now familiar in every day business and social life, it seems to us that if inventors will give the plan a trial, they will benefit themselves. It is the lot of the majority of inventors to be among the poor of this earth. They, therefore, can afford least of all men to spend long years and scant dollars in working at devices that will never be worth anything; and, on the other hand, they are the class most requiring help and backing if their ideas are sound and practicable. The company are prepared to tell the inventor whether he has a good thing to patent, or a bad; and if the former be the case, then they will go further, and, should he so choose, exploit the invention for him. This is, in reality, calling the principle of co-operation as applied to finance, commerce and industrial processes, into the field of invention, and combining money with brains to the profit of both.

One part of the business of the company, too, will be the making of accurate and delicate tests, as well for manufacturers and others employed in electrical pursuits as for inventors, and the apparatus provided is of the most costly and efficient character. The experts of the company will at all times be available for general work of this character. It is also proposed to produce and keep in stock all the standard supplies required the year round by telegraph, telephone and electric light companies. Altogether, the company begin with excellent prospects in a good field, and have our best wishes for their success.

N. Y. ELECTRICAL SOCIETY.—The first meeting of the season will be held Wednesday, Oct. 8, at their new room, 25 Cooper Union. The library is now open every day from 10 to 5, and every Wednesday evening until about 10 o'clock. One subject for discussion Oct. 8 will be the Electrical Exhibition.

WESTERN ELECTRIC COMPANY'S OPERATIONS.—Among the latest productions of this company are switch-boards for Louisville, Pittsburgh and Boston. It will be remembered that a new board was made lately by the company for Boston. The board was not sent, however, as it was found possible to make another of same capacity, but smaller, and in this are incorporated the very latest improvements. The company have also made several miles of aerial cable for the American Bell Company, to be used between New York and Boston.

TURNED UPON THE CELESTIALS.—A special correspondent at Foo-Chow thus describes the effect produced on the natives by an electric search light from the French flagship: "I happened to be going down to the anchorage last night in a steam launch, and just as Pagoda anchorage hove in sight the 'Volta,' the French flagship, lit her electric search lamp and threw a blinding ray on each Chinese gunboat in turn to see if they were slily slipping their anchors or rigging torpedoes. I steamed through the Chinese fleet while the search light was on them, and the effect was most ludicrous—the cries and antics of the men on board, who seemed to think there was something very awful in a light so strong that their eyes could not bear to look at it. It was a curious sight seen from a little distance; the night was slightly hazy, and the ray from the lamp seemed like a gigantic wedge-shaped arm thrown out by the vessel. The Volta had two torpedo boats alongside, with steam up, and all on board were moving about in an excited restless manner.

THE TELEGRAPH.

Northwestern Directorate.—At the annual meeting of the Great Northwestern Telegraph Company of Canada, the following directors were elected: Chas. Tinker, E. Wiman, New York; Hon. Wm. McDougal, Ottawa; F. S. Irving, Jas. Hadley, Wm. Gooderham, Toronto; Richard Fuller, Adam Brown, Hamilton; O. S. Wood, Montreal. Erastus Wiman, of New York, was re-elected President, and Wm. Gooderham, Vice-President.

The B and M. in Chicago.—It having been telegraphed from Chicago on the 26th that all of the offices of the Bankers and Merchants' Telegraph Company in that city had been closed, Receiver Smith, who was found at the New York office, made the following explanation: "The creditors have taken possession of the company's property in Chicago. The wires were maliciously cut at six or seven places just outside of the city, but the damage was repaired and business is going on as usual. The company has use of the Postal Company's wires under the pooling agreement. The papers in the matter of the appointment of a receiver have been forwarded to Chicago and will be confirmed by the Supreme Court of Illinois."

An Old Telegraph Capitalist.—James B. Stone, formerly a well-known resident of Milwaukee, died at his home in Oshkosh, Wis., Friday morning, Sept. 26. He was born March 14, 1829, in Franklin County, Vt., and went West when only 12 years of age to Kenosh, where he learned telegraphing with the late Senator C. C. Sholes. He was the originator of the Wisconsin Telegraph Company. This company, which had a capital stock of $50,000, was afterward purchased by a number of capitalists, who formed the Northwestern Telegraph Company, which in turn was purchased by the Western Union three years ago for $3,000,000. Although interested in a number of great schemes which turned out to be very remunerative, Mr. Stone died comparatively poor. He was a descendant of the Pierpont branch of the Stone family, of which President Arthur is a member.

THE TELEPHONE.

E. Goldenberger, of Reading, Pa., Division Supt., severs his connection with he Pennsylvania Telephone Company Oct. 1.

The Texas Pan Electric Co.—We learn that the Pan-Electric Co. is progressing rapidly in Texas. At Fort Worth, there are over 200 subscribers on the exchange list. Exchange connections are now about complete. Several territorial lines are in operation and others are being built. The general management is in the hands of Mr. Max Elser, one of the oldest line contractors in that part of the country. Mr. J. G. Watkins is the electrician for the whole State.

THE ELECTRIC LIGHT.

Chicago Driving Park.—It is proposed by the authorities to have no fewer than 330 electric lights at the Chicago Driving Park, hung over the track at intervals of only 20 feet. Stables, etc., will also be illuminated electrically. Madison street, for about a mile, as far as Western avenue, will also be lit up. The Western Electric Company are to furnish no fewer than 230 of the above-named lights, and the Excelsior Company 100.

To Light Philadelphia's Squares.—Representatives of four electric light companies appeared before a sub-committee of the Philadelphia Councils Committee on Markets and City Property last week and explained the merits of their respective systems. The companies represented included the Underground Electric Light and Power Company, Excelsior Electric Light Company, Brush Electric Light Company, and United States Electric Lighting Company. The committee had been directed to receive proposals for lighting Independence, Washington and Rittenhouse squares, with the understanding that the lighting was to be done by underground wires. The Underground Electric Light company was the only concern ready to comply with the conditions. A representative of one of the other companies suggested the passage of an ordinance authorizing the Commissioner of City Property to take contracts with one or more companies to light the squares by electricity, the wires to be laid underground, and each company to have the right to open the streets (in order to connect with the base of supply), and to give bonds in the sum of $5,000 for the faithful performance of the contract. The committee men discussed the question, but adjourned without taking any action.

MISCELLANEOUS NOTES.

To Prevent Earthquakes.—A crowd gathered on the lower side of Union Square, one night last week, to watch a fine-looking, swarthy man, dressed like a prosperous mechanic, who was gazing upward and talking wildly. He was removed to the insane pavilion at Bellevue Hospital. He would not give his name, but said he had been commissioned by President Arthur to cut all the telegraph wires to avoid another earthquake.

The Wave Theory of Light.—Sir William Thomson lectured at the Academy of Music, Philadelphia, on the 30th ult., under the auspices of the Franklin Institute, and with the aid of the University of Pennsylvania, upon the wave theory of light. On the platform were Profs. Barker, Houston and Snyder, and President Tatham of the Institute. The lecture was most able and interesting, and was illustrated by succeesful experiments, showing the different lengths of light and sound waves.

An Electric Railway in St. Louis.—A dispatch of Oct. 1, from St Louis says: The Model Electric Elevated Railroad, run by a new motor invented by Dr. W. F. Adams, was put in working order at the Exposition building yesterday. The power is distributed from a central station and runs along a wire laid under the car track similar to the cable of a cable road and gripped in a similar manner by a wheeled grip, by which it communicates a current to an electric motor under the body of the car. The machine appeared to be a success. A full-size car, of twenty-five horse-power, will shortly be set running in Machinery Hall, and this winter it is intended to have built and in operation an elevated street railroad, the franchise of which is applied for.

STOCK QUOTATIONS.

Telegraph, telephone and electric-light quotations on the New York Stock Exchange, the Boston Exchange and elsewhere, are as follows:

Telegraph.—Am. Cable, b 52, a 54; B. & M., a 7; Mutual Union, b 13, a 16; Postal stock, b 2⅝; Postal sixes, b 26½, a 29; Western Union, b 64¾, a 65.

Judge Donohue has authorized the Receivers of the Bankers & Merchants' Telegraph Company to issue certificates for $50,000, the money derived from them to be used in the payment of salaries and the running expenses of the business. The certificates are to be first liens on the property in the hands of the Receivers.

Telephone.—Am. Bell, b 170; a 173; Erie, b 19½; a 19⅝; Mexican, b 1¾; New England, b 27⅞; a 28; People's, a 9½; Tropical, b 1¼.

The Boston *Herald* of Oct. 1, says:

Bell telephone was the local leader in the improvement, advancing from 166 to 173, out of compliment to Mr. Storrow's argument in the great suit on trial in New York, or for other less apparent cause connected with the Bell-Drawbaugh controversy. New England was steady at 27¾@28, and Erie stronger at 19½@19⅝. Bell sold at 169 ex-dividend of 3 this afternoon.

Electric Light.—Edison, b 50; a 90.

BUSINESS NOTICES.

Electricity Without Cost.—The attention of capitalists is directed to the photo-electric battery advertised in another column, which would seem to work a great advance in electrical science. As Mr. Fritts states that he is prepared to practically demonstrate the process, all interested would do well to investigate.

The Ide Engine.—A 50 h. p. Ide engine has just been shipped from the works, at Springfield, Ill., to Messrs. F. S. Hefferman and James Reilly, Springfield, Mo., for a 50-light Van Depoele plant those gentlemen are starting there. Mr. Ide has received an order for shipment in October of a 150 h. p. engine for the Boulton Carbon Works, Cleveland, O., for their new factory.

Partrick & Carter.—The recent death of Mr. James Partrick will make no change in the business of Partrick & Carter, as he retired from the firm on the first of January last. The business will be carried on as heretofore by Mr. Carter and the Wilkins Brothers. In such good hands, it will grow and advance as of old. We were glad to see Mr. E. Ward Wilkins in town last week.

A Magnificent Magic Lantern.—The World Manufacturing Co., 122 Nassau street, offer in this issue, for $12, the Electro-Radiant Magic Lantern, which is honestly worth twice the money. The principle upon which this lantern is constructed is at once novel, ingenious and admirable. With this apparatus any one of ordinary education and ability can give an excellent entertainment and make a considerable profit in a few nights on the outlay. The illustration in the advertisement gives a clear idea of the appearance of the lantern No. 2.

The Kerner Stylographic Pen.—The pen made by the Kerner Stylographic Pen Company, 25 Bond street, New York, has special features of merit in the capillary needle bar, the flexible diaphragm and the vibratory air tube, and it has the great recommendation of being without parts that can rust or corrode. Among the testimonials given it is one from Mr. Chas. S. H. Small, Assistant Superintendent of the Gold & Stock Telegraph Co., who says: "It is a marvel of convenience and cheapness, and should be in the hands of every telegrapher." Several telephone men also indorse it publicly and in the heartiest manner.

The Fitchburg Automatic Cut-off Engine.—This engine, made by the Fitchburg (Mass.) Steam Engine Company, is well known, but probably our readers are not aware that there are nearly 1,000 of the engines now in use. They are adapted for all purposes requiring steady power economically produced, and have thus been largely employed in electric lighting plants. In construction the engine is simple, and it has proved itself also to be durable. The engine can be had up to 500 horse-power. Catalogue B of the company gives a quantity of interesting information in regard to the engine, and can be had on application.

Selling American Patents Abroad.—Inventors will be interested in an advertisement which appears in our columns to-day under the head, "Patents Negotiated Abroad." It appears that an association of gentlemen—among whom are Henry A. Herbert, the President of the Company, who, we are informed, is an ex-member of Parliament, and Prof. Silliman, of Yale College—has been formed in New York for the purpose of aiding American inventors in the disposition of their valuable patents. As this association appears to be acting in conjunction with a London company, and claims to have agents in Paris, Brussels and Berlin, it would seem that it supplies a want which American inventors must long have felt—namely, a responsible and reliable agency for disposing of their inventions in foreign countries.

A Sumptuous Catalogue.—We have received from Messrs. Manning, Maxwell & Moore, 111 & 113 Liberty street, New York, a copy of their richly bound and copiously illustrated catalogue of railway and machinists' tools and supplies. The firm are agents for some of the largest machine and tool manufacturing concerns in the country, the list of whose varied productions fills no fewer than 660 large quarto pages. Among the specialties are gas engines, drills, boilers, lathes, recorders and indicators, valves, steam yachts, saws, petroleum oil engines, hammers, etc., and nothing large or small in machinery or machine supplies is neglected. With the illustrations and the prices, as furnished, a good idea of suitability can be formed in regard to any article named and wanted.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

Edited by N. S. KEITH, Electrical Engineer and Expert, 9 Murray Street, New York.

PATENTS DATED SEPT. 16, 1884.

Autographic Telegraph; M. Hoffman Wilson, Brooklyn, N. Y. 305,259

A single line-wire is connected with a number of branch wires, which have their terminals arranged side by side in the path traversed by the form, and in said application the branch wires are divided or interrupted, and a rotating commutator, which is external to the main circuit, is arranged to move between and in contact with the interrupted ends of the branch wires, and thereby to close the circuit through said branch wires and to the main-line wire successively. Branch wires are employed end to end, and a commutator adapted to make contact with the ends of the branch wires successively, and arranged in the main circuit, the main-line wire being connected with the commutator-hub or its shaft.

Carbon Battery; Thomas W. Bryant, Ansonia, Conn. 305,046

An improvement on the "Diamond Carbon Battery." The plate-cover is made of metal, the carbons are fastened directly thereto, and the zinc is passed through a hole in the centre of the plate, but insulated therefrom.

Electric Arc Lamp; Norman McCarty, Brooklyn, N. Y. 305,096

Consists in combining with the main circuit and shunt magnets, a device whereby the automatic action of the shunt tends to complete the circuit through the main magnet after it has been closed through another line around the magnet.

Electric Arc Lamp; Edward Granert, New York, N. Y. 305,175

Consists of a main solenoid having a hollow core inclosing the upper carbon holder, and means by which the same is raised, retained or dropped.

It further consists of means for short-circuiting the lamp by a vertical side-armature of the main solenoid, an oscillating contact-spring, an auxiliary solenoid and its armature-lever, which latter has a wedge-shaped insulating arm that breaks the contact of the spring with an upright post.

Electric Brush; Mary McMullin, Middlesex, England 305,321

A small battery is inclosed in the back or body of the brush.

Electrical Cigar-Lighter; Richd. N. Dyer, New York, N. Y. 305,164

A torch is dipped into alcohol, and when raised to light a cigar an electric circuit is automatically made, and a wire made incandescent thereby to light the alcohol on the torch.

Electrical Circuit-Closer; Thomas W. Bryant, Ansonia, Conn 305,045

Is operated in a manner similar to a gas-cock, which it resembles.

Electric Circuit-Closer; John H. Holmes, Newcastle-upon-Tyne, England 305,310

The contact surfaces are separated very suddenly by the operation of a spring when released by a key.

Electric-Lamp Mechanism; Elihu Thomson, New Britain, Conn. 305,413

Consists in making one of the magnets, preferably the lifting or coarse-wire magnet, stationary, while the other, the shunt or fine-wire magnet, is arranged with relation to the first and made to rock upon a pivoted support. This peculiar movable magnet carries an arm which acts upon a clutch upon the carbon rod, or upon any equivalent regulating device if desired.

Electrical Railroad; Theophilus P. Chandler, Jr., Philadelphia, Pa. 305,147

A suspended cable track; one cable above the other.

Electric Railway Signal; Wm. Vogel, Chicago, Ill. 305,359

It consists, in part, in the combination of contacts placed along the road and connected to the battery at the station, and other contacts connected with a telephone or other electrically-operated device at the station and used in connection with the battery contacts, contacts on the locomotive, an electrically-operated power mechanism and a telephone or other electrical device on the locomotive and the wires which extend from the station and connect with the contacts along the track; second, in the combination of the strong battery, the weak battery, switches, telephone and alarm bell with conducting-wires, the two pair of contacts placed along the road, contacts on the locomotive and a telephone, switch and alarm-bell on the locomotive; third, in the combination of the electro-magnet, armature, train of wheels and a mechanism for blowing the whistle.

Incandescent Electric Lamp; Wm. Holzer, Harrison, N. J. 305,191

The glass around the leading-in wires is divided into two portions, and each one of the portions is pressed closely around its appropriate wire, for the purpose of insuring a more nearly perfect sealing.

Lightning-Rod Coupling; Sylvester Bradley, Bloomington, Ill. 305,140

A screw coupling integral with the parts of a tubular conductor.

Mechanism for the Electrical Transportation of Goods; Fleeming Jenkin, Edinburgh, Scotland.. 305,194

Apparatus for "Telpherage;" the system described in The Electrical World's issue of May 10, 1884.

Reflector for Incandescent Lamps; Philip H. Klein, Jr., New York, N. Y. 305,200

The reflector is made concave, and is centred on the support of a cluster of incandescence lamps.

Telegraphic Transmitter for Unskilled Operators; Theodore Ames, Hackensack, N. J. 305,262

For transmitting Morse signals by an operator playing on keys. It consists in peculiar construction and arrangement of parts.